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Bulletin No. 201-250 January, 1922

REPORT FROM SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION FOR 1921

By E. B. FERRIS

132839

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E. B. FERRIS, M.Sc.....Assistant Director, South Miss. Branch Station
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M. E. ANDREWS, M.S.A.....Associate in Farm Management
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D. MAXWELL.....Foreman, Horse and Beef Barns

* In Cooperation Bureau of Animal Industry, U. S. Department of Agriculture.

Report of Work at South Mississippi Experiment Station For 1921

By E. B. FERRIS.

Introduction.—The work of this Station up to 1921 has been pretty thoroughly covered by several bulletins and reports issued in December of 1920. There has been no material change in the character of this work except the addition of special work with garden and orchard crops under the supervision of Mr. Richardson which he has gotten well under way and on which he reports in his own way.

The outline of work as approved by the general committee of station workers has been followed almost to the letter and we are able to report reasonably good progress with all these experiments. The first of these approved projects was to study the effects of different kinds and combinations of plant food elements on the yield of cotton. This is a continuation of work started many years ago at McNeill and renewed here at Poplarville three years ago in a way to increase the accuracy and efficiency of the work.

In 1919 a number of plats of land as nearly uniform in composition and as level as we could find were set aside for permanent work with fertilizers under cotton and corn. The arrangement of these plats so as to insure maximum accuracy of results is described in detail in bulletin No. 194 of this Station. As mentioned in this bulletin, at the end of 1919 we decided to devote all of these plats to work with cotton alone as there had always been such a seeming lack of uniformity to all our work with fertilizers under corn. So, in 1920 all work with fertilizers under cotton on said plats was done in duplicate and were so reported in this bulletin No. 194 under series A and B.

Series A was on land a little lower than Series B, and in years past had received some washing from it, but in the beginning of our work a broad, shallow ditch was run between the two series so as to prevent any further washing. Reference to the work of 1920 will show that the average acre yield of all plats fertilized and unfertilized, on series A was 147 pounds more of seed cotton than that of series B, this to give a general idea of the natural fertility of the plats of land and to show more accurately the effects of lime applied later to one of the series.

In February 1921 series A was limed with natural lime rock bought from the state penitentiary plant at Waynesboro. This was weighed separately for each plat and distributed by hand so as to insure uniformity of application to the twenty-eight plats. A little later all plats on series A and B were fertilized exactly as they had been in 1920 except in 1921 we used cottonseed meal instead of calcium cyanamid as a source of nitrogen. Series B was, of course, left unlimed, but in every other respect the two series were given exactly the same treatment. They were fertilized at the same time exactly in duplicate, prepared, planted, hoed and cultivated at the same time and each received three applications of calcium arsenate at intervals of five days beginning July 16. In fact, while there was a broad ditch between the two series, it was shallow enough to permit of crossing with all implements and cultivation was continuous between the two series.

The weather conditions in 1921 for growing cotton were unusually favorable and while the boll weevil appeared early and in great numbers there was enough dry weather to control the insect very largely by cultural methods. All this cotton was poisoned three times against the weevil and this no doubt helped considerably, still other cotton grown nearby without the poison made excellent yields.

In 1921 series A (limed) made an average yield per acre of 188 pounds of seed cotton more than series B (unlimed), but as stated before the yield in 1920 before applying the lime had been 147 pounds greater, so that at best a gain of only 41 pounds per acre can be attributed to the use of lime and even this might be due to the fact that 1921 was a much dryer year than 1920, the cotton on the lowest parts of series A matured relatively better than in 1920.

In the fall of 1920 samples of soil were taken from many different parts of each plat and sent to the chemist at the A. & M. College for analysis with a view to seeing if any thing could be found out about the influence of average applications of commercial fertilizers on the food content of soils as determined by analysis. Another interesting feature of this work has just been started in which samples of cotton are taken from the various plats to see how the various kinds and combinations of plant food elements will affect the length, strength and other qualities of the cotton. If any thing of value should be found it will be embodied in a later report.

The variety of cotton used in this work was Trice grown at Holly Springs, Miss. On April 12 and again on April 19, home grown Trice seed had been planted without getting a stand. This was due largely to unfavorable weather and we thought partly to poor seed, so on May 7, the final planting was made as above indicated.

All cotton had matured when picking began and the table following gives the results in detail:

TABLE No. I.—Results of Tests with Fertilizers Under Cotton on Limed and Unlimed Land. Series A Limed; Series B Unlimed. Both Series fertilized in duplicate, except the lime.

No. of Plat	FERTILIZER CALCULATED IN POUNDS PER ACRE	SERIES A		SERIES B		
		Yield of seed cotton calculated in lbs. per acre	Increase over check	Yield of seed cotton calculated in lbs. per acre	Increase over check	Av. increase over check Plats
1	240 lbs. Acid phosphate	1026	324	846	360	342
2	Check	702		486		
3	240 lbs Cottonseed meal	864	162	612	126	144
4	120 lbs. Nitrate of soda	918	252	540	144	198
5	Check	666		396		
6	240 lbs. Acid phosphate 240 lbs. Cottonseed meal	1476	810	1134	738	774
7	240 lbs. Cottonseed meal 240 lbs. Kainit	1134	216	918	288	252
8	Check	918		630		
9	240 lbs. Acid phosphate 240 lbs. Kainit	1206	288	1080	450	369
10	240 lbs. Acid phosphate 240 lbs. Cottonseed meal 240 lbs. Kainit	1386	378	1212	636	507
11	Check	1008		576		
12	240 lbs. Acid phosphate 120 lbs. Nitrate of Soda 240 lbs. Kainit	1476	468	1116	540	504
13	240 lbs. Basic Slag	1134	−36	684	−274	−155
14	Check	1170		954		
15	Check	684		621		
16	240 lbs. Raw phosphate rock	558	−126	711	90	−18
17	240 lbs. Kainit	954	360	846	45	202
18	Check	594		801		
19	240 lbs. Basic slag 240 lbs. Cottonseed meal 240 lbs. Kainit	1008	404	1116	315	359
20	240 lbs. Raw phosphate rock 240 lbs. Cottonseed meal 240 lbs. Kainit	1026	306	1134	468	387
21	Check	720		666		
22	240 lbs. Acid phosphate 240 lbs. Kainit 60 lbs. Nitrate soda, April 1 60 lbs. Nitrate soda, June 1	1296	576	1224	558	567
23	240 lbs. Acid phosphate 240 lbs. Kainit 60 lbs. Nitrate soda, June 1 60 lbs. Nitrate soda, July 1	1116	288	846	225	256
24	Check	828		621		
25	480 lbs. Acid phosphate 240 lbs. Kainit 120 lbs. Nitrate soda	1332	504	990	369	436
26	240 lbs. Acid phosphate 120 lbs. Kainit 240 lbs. Nitrate soda	1278	198	1044	549	373
27	Check	1080		495		
28	240 lbs. Acid phosphate 480 lbs. Kainit 120 lbs. Nitrate soda	1098	18	1368	873	445

Remarks on Cotton Variety Work.—All cotton here began opening early in August Frequent showers with several very hard rains during the latter part of August and during September kept the cotton damp a great deal of the time, causing the burs of the cotton bolls to decay to the extent that it was quite difficult to pick the cotton This was responsible for the very poor showing that the samples from these varieties made when sent to the classers. No doubt the same cause which weakened the bolls also weakened the fiber of the cotton. Samples from all these varieties were sent to Greenwood, Miss., for classification as well as for determining the selling price. All varieties under 7–8 inch staple were reported by them as being in no demand, so later samples of these short cottons were sent to buyers in Hattiesburg who fixed their values as given in the table. These Hattiesburg buyers made no distinction in values due to length of staple, but based their values on grade entirely.

Cotton Varieties.—Early in 1921 the only land we had available that was level enough for conducting experimental work in straight rows was limed at the rate of two tons per acre, manured at the rate of about four tons per acre and thoroughly disced. Land heretofore used at Poplarville for work of this character had been given over to the horticulturist on account of its superior adaptability for vegetables and fruits.

This new land while fairly level proved not to be very uniform in composition due to the fact that parts of it had been allowed to wash before we took charge and while this erosion had been stopped, it left the surface soil much thinner in some places than in others.

In order to use this land so as to get straight rows and prevent washing, it was laid off into very long rows, running north and south, each three and one-half feet apart These rows were 225 yards long and were divided in the middle by a space one yard wide, giving two series of rows. Twenty-four varieties of cotton were to be tested, so 48 rows were run the entire length of the field, giving two rows of each variety to both series or a total of four rows to the variety. These rows were fetilized in the drill with a mixture of equal parts cottonseed meal and acid phosphate at the rate of 500 pounds per acre, this mixed in the drills and bedded upon. The varieties were distributed over the land so as to do away as largely as possible with variations in yield due to inequalities of the soil. We found later that there was a vast difference between the productive capacity of the two series into which the work had been divided which interferred seriously with a second test carried on at the same time to determine the effects of poisoning against the boll weevil, but which did not interfere with the comparative yields of the varieties themselves since they were equally distributed over both series.

These varieties were planted on April 12, but on account of cold weather and heavy rains did not come up to a good stand and all were replanted on April 28. Seasons after this were fairly favorable, much dryer than the average year and altogether in favor of controlling the weevil. These weevils put in their appearance very early in the spring and the north half of the field devoted to this variety work was poisoned four times with calcium arsenate beginning July 15, and ending July 30, while the south half of the field was left unpoisoned as a check. We made several observations during the growing season to see if the poison was showing any effect and while the cotton on the north end had many more bolls, the stalks were very much larger and we could never believe that the difference was due to the poisoning. At the end of the season the 48

rows on the north end had made a total of 2,707 pounds of seed cotton while an equal area on the south end made only 1,271 pounds. All this cotton was picked at one time, each row being weighed separately and the four rows of each variety on north a nd south series added together and calculated to acre yields. Twenty-five pound samples of each variety weretaken out and sent to the A. & M. Colleg to be ginned, graded, etc.—The following table gives results of all this work in detail:

TABLE No. 2.—COTTON VARIETY TEST, 1921.

Summary of results with varieties of Cotton at Poplarville, 1921; calculated in pounds of seed cotton per acre.

Plat No.	Name of Variety	Strength of Staple	Character of Staple	Value per lb.	Yield seed cot. per acre	Lint per cent	Amt. Lint per A.	Length of Lint	Value Lint per A.	Value Seed per A.	Total Money Value	Rank in Mon Value
1	Simpkins	Poor	Poor	13¾	1746	38.2	666.9	5/8	91.70	15.11	106.81	14
2	Trice 270–41	Fair	Fair	22	1647	32.9	541.9	1 1/16	119.21	15.47	134.68	5
3	Wannamaker Cleveland	Weak	Poor	13¾	1449	37.1	537.5	½	73.90	12.76	86.66	19
4	Cleveland 37 W.–54	Poor	Poor	13¾	1530	35.2	538.5	5/8	74.04	13.88	87.92	18
5	Piedmont Cleveland	Weak	Poor	16	1899	34.5	655.1	7/8	104.81	17.41	122.22	9
6	Cleveland Big Boll	Weak	Poor	13¾	1305	35.8	467.2	5/8	64.24	11.73	75.97	20
7	Cook 1010	Weak	Poor	12¾	1683	39.0	656.3	½	83.67	14.37	98.04	15
8	Half and Half	Poor	Poor	12¾	1746	42.4	740.3	½	94.38	14.08	108.46	13
9	Miller	Weak	Poor	13¾	918	35.9	311.2	½	42.79	8.50	51.29	24
10	Triumph	Poor	Poor	12¾	1647	36.7	604.4	5/8	77.06	14.60	91.66	16
11	Lone Star	Weak	Poor	16	1098	36.1	396.3	1	63.41	9.82	73.23	21
12	Lone Star 11–65	Fair	Poor	24	1980	33.5	663.3	1 1/16 - 1 1/8	159.19	18.43	177.62	2
13	Acala No. 5	Weak	Poor	16	1017	35.5	361.0	1	57.76	9.18	66.94	23
14	D. & P. L. Co., No. 1	Good	Fair	26½	1494	35.8	534.8	1 1/8	141.72	13.43	155.15	4
15	Express 432	Fair	Fair	22	1152	31.6	364.0	1 1/16	80.08	11.03	91.11	17
16	Express 432–762	Fair	Fair	27	1818	31.3	569.0	1 1/8 – 1 3/16	153.63	17.38	161.01	3
17	Express 122–433	Fair	Poor	25	1539	30.9	475.5	1 3/16	118.87	14.89	133.76	6
18	Express 350–718	Weak	Poor	24	1422	28.6	406.7	1 1/8	97.61	14.21	111.82	11
19	Foster 6102	Fair	Poor	27	1926	32.5	625.9	1 3/16 to 1¼	168.99	18.20	187.19	1
20	Foster 631	Weak	Poor	24	1467	31.5	462.1	1 3/16	110.90	14.07	124.97	8
21	Sunflower – Express	Fair	Poor	27	1503	27.9	419.3	1 3/16 to 1¼	113.21	15.17	128.38	7
22	Webber 49	Fair	Poor	27	1359	28.9	392.7	1 3/16 to 1¼	106.03	13.53	119.56	10
23	Delta-Type Webber	Fair	Fair	28	1188	29.4	349.2	1 3/16 to 1¼	97.77	11.74	109.51	12
24	Bank Account	Poor	Poor	12¾	1377	33.4	459.9	5/8	58.64	12.84	71.48	22

Spacing Work with Cotton.—This is a continuation of similar work started here in 1920 and was conducted in the same field just described under work with varieties, though the natural fertility of the soil was not nearly so good, due to previous erosion. Here, both the north and the south ends of the field were a little broken and had suffered some erosion in the past and lacked uniformity to a much greater extent than the land used for varieties. This lack of uniformity was apparent before planting and we distributed the several ways of spacing over the land so as to make the average results as reliable as possible.

In this work six rows were used in each test and these tests were each repeated four times making the acreage large enough to insure reasonably reliable results. Only three distances were used, 6 inches, 12 inches and 24 inches. The 6 inch spacing was left just as the cotton came up from planting and was a little less than six inches in some places and a little more in others; the other spacing was carefully done with a hoe. The rows were three and one-half feet wide and were fertilized in the drills with a mixture of equal parts acid phosphate and cottonseed meal at the rate of 500 pounds per acre. Home grown Trice seed were planted April 12, and again April 20, and after failing to get stands both times we planted Trice seed from Holly Springs on May 7, and got good stands. A Ledbetter one-seed planter was used. All this cotton was poisoned four times with calcium arsenate at intervals of five days beginning July 15.

The following table gives the results of this work:

COTTON SPACING WORK.

Distance in Drill	Yield Seed Cotton per acre 1st Series	Yield Seed Cotton per acre 2nd Series	Yield Seed Cotton per acre 3rd Series	Yield Seed Cotton per acre 4th Series	Average Yield Seed Cot. per acre
6 inches.....	1437	919	*758	981	1026
12 inches.....	956	857	870	833	879
24 inches.....	1011	777	*648	931	842
Remarks.....			*Poor Soil		

VARIETY TESTS WITH CORN

Variety Work with Corn.—The same field above described as having been used for variety and spacing work with cotton was used also for variety work with corn. The land was limed, manured and fertilized just as that had been for cotton and being located on the east side of the field was more uniform in character and possibly averaged a little better in quality than that used for variety work with cotton.

The corn rows were three and one-half feet wide, 225 yards long and divided in center into two halves, fertilized in the drills with a mixture of equal parts acid phosphate and cottonseed meal at the rate of 500 pounds per acre and twenty varieties of corn planted on April 11. This came up to a perfect stand and was thinned to about two feet in the drill.

There were four rows planted to each variety and these distributed over the area used so as to give every variety equal advantage as to land. The usual cultivation was given and all corn gathered when fully mature, husked, weighed, and equal quantities shelled as per table.

TABLE 3.—Corn Variety Test, 1921.

No. of Plat	Name of Variety	1st Grade Bu. per acre	2nd Grade Bu. per acre	3rd Grade Bu. per acre	Per ct. Grain	Total Yield Bu. per acre	Relative Development July 1
1	Hastings Prolific	26.1	3.2	.8	80	30.1	Full silk and tassel
2	Biggs 7-Ear	22.5	8.0		84	30.5	More advanced than No. 1
3	Cocke's Prolific College	26.0	3.3		84	29.3	About as No. 2
4	Cocke's Prolific Delta Sta.	24.8	3.6		84	28.4	About as No. 1.
5	North Carolina Prolific	17.5	8.6		86	26.1	More adv. than any pl't'ng
6	Ellis	20.2	4.7	.4	84	25.3	Full tassel, few silks
7	Johnson Prolific	25.4	3.0		88	28.4	Full tassel, many silks
8	Mosby Prolific	16.8	4.3		87	21.1	Full tassel, largely silked
9	Mosby 436	27.9	4.2	.4	87	32.5	Full tassel, half silked
10	Marlboro	20.3	3.2		84	23.5	Full tassel, full silked
11	Whatley	19.2	5.8		87	25.0	Full tassell, half silked
12	Laguna	16.7	9.9	.4	86	27.0	Full tasselled, third silked
13	Paymaster Neal	9.4	15.7	.5	86	25.6	Full silked and tasselled, Well advanced
14	Paymaster Harpeth	14.8	13.1	.5	85	28.4	Better advanced than 13
15	Tenn. Red Cob No. 1	16.1	9.9	.2	84	26.2	Tull tassel, third silked
16	Tenn. Red Cob, No. 72	13.5	8.9	.6	83	23.0	Full tassel, third silked
17	Chisholm	13.1	9.1	.8	83	23.0	Full tassel, half silked
18	Williamson	18.0	3.7	.5	86	22.2	Full tassel, few silks
19	Florida Flint	23.5	4.5		87	28.0	Full tassel, full silked
20	Yellow Dent	6.7	11.4	3.0	84	21.1	About like 14

Tests with Fertilizers under Corn.—In 1920 work was started here with fertilizers under corn particularly with the idea of testing out several sources of nitrogen and phosphorus alone and in combination. Twenty-four plats of land were set aside then for permanent work of this kind and reference is made to Table 2 of bulletin No. 194 for results obtained last year. Our experience covering many years has been that results with fertilizers under corn are very variable and in many instances seemingly of little value. This was particularly true of last year's results where the work had just been started and the influence of previous fertilization evidently affecting the yields. The same plats were very largely fertilized the same way again this year and the results are considerably more uniform.

The land used for this work is a narrow strip 130 feet wide by 660 feet long and in order to prevent washing the field is divided the long way into four series of plats, each 154 feet long by twenty feet wide. This gives six plats to each series, five of these being fertilized while one plat of each series is left unfertilized as a check The several series evidently vary a lot in natural productiveness as judged by the way the yields drop from plats 1 to 6 in the first series to plats 19 to 23 in the 4th series, there being a gradual drop in the check plats of each series from 22 bushels to 12 bushels. Only by taking this into consideration and by observing the increase in yields over the respective checks are the results worth any thing at all in showing the true influence of the fertilizers.

Fertilizers were applied to these several plats on April 7, and on the same day a local variety of corn, selected because of its resistance to weevils was planted. The seasons were fairly good, the corn grew off nicely and when thoroughly dry in the fall this was gathered and weighed and the results are reported in pounds of ear corn and bushels of shelled corn per acre.

The following table gives this work in detail:

TABLE No. 4.—Results of Tests with Fertilizer under Corn, 1921; being a repetition of work done in 1920. Apparently of little value due to lack of replication. Land lacking in uniformity.

	No. of Plat	Fertilizer Calculated in Pounds per Acre	Ear corn in lbs. per plat	Corn in ear in lbs. per acre	Corn calculated in Bu. per acre	Increase over check
DIVISION No. 1	1	280 Acid Phosphate 280 Cottonseed Meal 140 Kainit	81	1890	26.2	3.9
	2	280 Acid Phosphate 140 Nitrate of Soda 140 Kainit	95	2216	30.8	8.5
	3	Check	69	1610	22.3	
	4	280 Basic Slag 280 Cottonseed Meal 140 Kainit	99	2310	32.1	9.8
	5	280 Acid Phosphate 140 Calcium Cyanamid 140 Kainit	85	1983	27.5	5.2
	6	280 Acid Phosphate 280 Cottonseed Meal	75	1750	24.3	2.0
DIVISION No. 2	7	280 Acid Phosphate 140 Calcium Cyanamid	54	1226	17.0	—3.1
	8	140 Ammonium Sulphate	62	1447	20.1	
	9	280 Acid Phosphate 140 Nitrate of Soda	89	2077	28.9	8.8
	10	Check	62	1447	20.1	
	11	280 Acid Phosphate 140 Ammonium Sulphate	69	1610	22.3	2.2
	12	280 Fla. Soft Phosphate 280 Cottonseed Meal	81	1890	26.2	6.1
DIVISION No. 3	13	280 Fla. Soft Phosphate 280 Cottonseed Meal 140 Kainit	53	1237	17.2	1.3
	14	Check	49	1143	15.9	
	15	280 Acid Phosphate 140 Am. Sulphate 140 Kainit	82	1913	26.5	10.6
	16	140 Calcium Cyanamid	64	1493	20.7	4.8
	17	140 Dried Blood	75	1750	24.3	8.4
	18	280 Cottonseed Meal	69	1610	22.3	6.4
DIVISION No. 4	19	280 Acid Phosphate	33	770	10.7	—1.3
	20	280 Raw Phosphate Rock	41	957	13.3	1.3
	21	Check	37	863	12.0	
	22	280 Basic Slag	40	933	13.0	1.0
	23	280 Fla. Soft Phosphate	40	933	13.0	1.0
	24	140 Nitrate of Soda	83	1937	27.0	15.0

In 1919 and 1920 twelve plats of land were used here for fertilizer work with sweet potatoes and were fertilized in accordance with suggestions from a committee of horticulturists from the Association of Southern Agricultural Workers. The results from this work for the two years have been published and we had intended continuing the work indefinitely until we found the land so badly infested with black rot as to make the growing of potatoes impractical, so the same plats were fertilized in the same way this year and planted to corn and below we give in tabular form the results obtained therefrom:

TABLE No. 5.

Results from heavy application of Fertilizer under Corn, in 1921.

No. of Plat	Fertilizer Calculated in Pounds per Acre	Yield of Corn in lbs. per plat	Yield of Corn calculated in lbs. per acre	Yields of Corn calculated in Bu. per A.	Increase over ch'k in Bu. per acre
1	400 Acid Phosphate 200 Cottonseed Meal 100 Nitrate of Soda	176	3168	44.0	5.5
2	Check	154	2772	38.5	
3	400 Acid Phosphate 200 Cottonseed Meal 100 Nitrate of Soda 200 Kainit	164	2952	41.0	2.5
4	400 Acid Phosphate 200 Cottonseed Meal 100 Nitrate of Soda 400 Kainit	160	2880	40.0	1.0
5	Check	156	2808	39.0	
6	400 Acid Phosphate 200 Cottonseed Meal 100 Nitrate of Soda 600 Kainit	165	2970	41.2	2.2
7	200 Acid Phosphate 200 Cottonseed Meal 100 Nitrate of Soda 400 Kainit	130	2340	32.5	5.0
8	Check	110	1980	27.5	
9	200 Cottonseed Meal 100 Nitrate of Soda 400 Kainit	120	2160	30.0	2.5
10	400 Acid Phosphate 400 Kainit	40	720	10.00	.8
11	Check	37	666	9.2	
12	400 Acid Phosphate 400 Cottonseed Meal 200 Nitrate of Soda 400 Kainit	114	2052	28.5	19.3

Rotations with Corn and Cotton with Bur Clover and Vetch.—In the fall of 1920 one acre of uniform land was selected for rotations with corn and cotton with bur clover and vetch as winter cover crops. This acre had grown cotton in 1920 after having been limed and fertilized well with animal manures. Before all the cotton had been picked in the fall of 1920 hairy vetch was sown on half this land and bur clover on the other half. Each half was inoculated with soil on which similar crops had grown at McNeill. Both crops came up to good stands and grew off well, the vetch making the better growth through the winter and much the more attractive growth in spring. This vetch covered the tops of cotton stalks that had been left for support and made a perfect flower garden when in bloom. Few of these blooms, however, formed pods, and still fewer of the pods matured seed. A false anthracnose attacks the crop here and as was the case at McNeill practically no seed were matured. On the contrary the bur clover, like the tortoise in the race with the hare, kept plodding along from the beginning and in the end outstripped the vetch. This clover completely covered the ground, bloomed freely, matured a heavy crop of seed and had died while the vetch was still green and we were hoping it might finally reproduce itself.

A number of bushels of clover seed were swept up and saved from this land, leaving on the ground many more than necessary to reseed it. Both vetch and clover were then run over with disc to cut up the litter and the land was turned with two-horse plow, corn planted and this harvested in September. Land was then turned again with the same plow and left alone. A complete stand of bur clover soon appeared and is now growing nicely. Only an occasional sprig of vetch can be found. This work will be continued until some definite conclusions are warranted.

Winter Legume Cover Crops.—In the fall of 1920 the U. S. Department of Agriculture furnished us with small quantities of a number of different kinds of clovers and vetches while the home station sent a considerable quantity of black medic clover seed. All were planted on land highly manured in plats 21x24 feet and when mature in the spring the surplus seed from each plat were saved for planting in greater quantity this fall. Practically all of the 25 kinds sent came up to good stands, six of the seven varieties of vetch made good growths, but none of the vetches matured seed at all well. All the eleven varieties of bur clover did well and the most of these matured many more seed than were required to reseed the land. We were especially impressed with Tangier peas and Ladino white clover among the kinds not included in the vetches or bur clover. Both made luxuriant growths on the very rich land on which they were planted.

When all these crops had matured, the plats were flat broken and the ground planted to two varieties of sorghum for silage. When this was removed the ground was again broken and left to see what the several kinds of crops would do toward renewing themselves. A number of the bur clovers are showing up. The surplus seed saved from the best of these crops last spring were this fall sown on ground used for permanent pasture following a crop of lespedeza of three years standing. It remains to be seen what they will do on land of medium fertility.

In addition to sowing the black medic clover on the small plats mentioned, a half-acre of land elsewhere was fertilized with animal manure in addition to commercial fertilizer and sown to this clover. This larger tract had been made nothing like so rich as the smaller plats and the clover made only a fair growth.

It apparently matured plenty of seed and after doing so the land was broken and planted to sorghum for silage. When this was removed in the fall the land was flat broken and left to come back to the clover, if it would. So far it has not shown up to any thing like the extent that the clovers are in other parts of the place.

Besides sowing the bur clover seed saved at home, we ordered two hundred pounds of seed elsewhere and during the past fall have sown a number of acres of cultivated land to it, besides some twelve acres of pasture. This has been sown on limed and unlimed, manured and unmanured land, and ought soon to give valuable information as to its value as a crop for the country as a whole.

Pastures.—Lespedeza and carpet grass are the crops that this country must depend upon for summer grazing and for three successive years by sowing oats on the lespedeza sod after seed were mature in the fall we have had fair grazing for practically ten months in the year. This requires annual sowing of the oats with rather more work and expense than the average farmer or stockman is willing to give. Bur clover and lespedeza should make good companion crops with a single sowing of each lasting indefinitely.

From a sowing of carpet grass seed in the spring of 1920 on a thirteen acre pasture here having land of all stages of development, we have obtained sods ranging all the way from the best to that practically worthless, depending very largely on the amount of work done in making ready the seed bed. When sown on the natural sod it has taken hold very slowly, but on either sod or cultivated land first broken and reasonably good seed beds prepared, it has practically covered the ground the first year and has furnished this year excellent grazing. Rows six feet apart have been streaked off across a part of this carpet grass sod with a middle burster, the furrows filled with manure, and a narrow seed bed prepared with a scooter plow on which bur clover seed have been sown during the past fall. It ought, if it does well, spread from this furrow and cover the entire ground.

In addition to this a strip of land 25 feet wide and several hundred yards long was broken on the upper side of this carpet grass pasture, this manured, fetilized and disced several times until a perfect seed bed was made. On this strip a number of varieties of clovers and vetches have been planted with the hope that if any are suited to the purpose they may spread down the hill by the natural washing of the seed.

Dairy Cattle.—This station has a small herd of dairy cattle, practically all registered Jerseys. Milk from them is sold in New Orleans and they are about paying their own way but not making any money. Our grounds here are too small for increasing this herd and even the land now devoted to pasture is badly needed for other things since the work with horticultural crops has been inaugurated. Except the cottonseed meal the feed for these animals is grown on the place, largely as silage made from sorghum and velvet beans grown with corn. During the past fall a hundred ton silo was filled from about five acres of sorghum grown on manured land and largely as a second crop. Following the clovers mentioned in this report two varieties of sorghum were grown, "Japanese Seeded Ribbon Cane" and Gooseneck. The first proved much the more valuable sorghum yielding at the rate of 21.9 tons per acre while the "Gooseneck" made 11.6 tons. The Japanese sorghum, too, stood up much better in the field, the Gooseneck falling so badly as to make it very difficult to handle with harvester. The Japanese variety over nearly five acres here closely approximated the yield as given in the actual test made which was on highly manured land.

REPORT OF HORTICULTURAL INVESTIGATIONS AT SOUTH MISSISSIPPI EXPERIMENT STATION.

By F. B. RICHARDSON, Horticulturist

Investigations in Horticulture were begun a year ago, October 1, 1920. The following lines of investigations are now under way:

I. Plant Breeding and Selection Work to improve varieties of fruit and vegetables.

II. Fertilizer Tests.

III. Variety Tests of Fruits and Vegetables, including tests of new plant introductions by the U. S. Department of Agriculture.

IV. Cultural Practices.

V. Experiments in Storage of Sweet and Irish Potatoes.

The report on above divisions follows, in order named.

I. Plant Breeding and Selection Work.—Necessity for this line of investigation has been called to the attention of this Station, especially with reference to Irish potatoes and tomatoes. Growers in this state claim that the northern grown seed of Irish potatoes fail to produce the crops formerly obtained, that the variety of Bliss Red Triumph is "running out." This work of testing and selection is especially well adapted to Experiment Station work, and projects along the lines indicated have been started. Work under this project is being done on the following crops: sweet potatoes, Irish potatoes and tomatoes.

Sweet Potatoes.—Variety used, Nancy Hall. The crop was grown from cuttings set out June 23rd, 15 inches apart; harvested November 24th, before any frost. Rows used for selection work were dug by hand, and each hill kept separate. Enough vine was left for each hill so stems could be examined. By this method some very fine hills were found, and some very poor ones. A good hill was judged by disease resistance, trueness to type, uniformity in size and shape of all the potatoes in the hill as a unit, productivity, and marketable size of the potatoes. Three bushels of the best seed hills were placed in storage, and one bushel of low yielding hills of undesirable type. Potatoes will be grown from each lot of seed next year in adjacent rows. Mr. A. A. Pigford, Lumberton, Miss., one of the leading potato growers of the South, saw this selection work at digging time, and states that this method of hill selection could be put into practical use by potato growers and should prove of much value. This plan is the same as field selection of seed corn.

Irish Potatoes.—Variety used, Bliss Red Triumph. The experiment was started with seed potatoes from Maine, and hill selection was followed at digging time with the spring crop, as described above for sweet potatoes. These selected tubers were spread in a single layer on the dry ground beneath the sweet potato house, exposed to indirect sunlight. Two weeks before planting time, the seed tubers were layered under six inches of oat straw—this straw was kept moist, and sprouting developed on practically all tubers. Whole tubers from this lot were planted two feet apart in the row, August 19th. Good stand secured. Plants with healthy foliage have been labeled; crop has not been dug yet, but all hills examined showed good yield. Hill selections will again be made to supply seed for the crop of spring, 1922, and the home grown seed will be compared with seed obtained again from Maine.

TOMATOES.—Variety used, Globe, which is the main commercial kind. Healthy plants, showing productiveness and uniformity were labeled, and seed saved from the fruits. Plants from these seed will be isolated from other tomato patches, and further selection carried out. Some of the plants from these selected seed will also be compared in rows adjacent to plants grown from northern seed. (See illustration of seed plant.)

II. Fertilizer Tests.—Two truck crops, sweet potatoes and tomatoes, are being tested for fertilizer requirements, and other crops will be used whenever facilities permit of extension of this line of investigation. The results given herewith cannot form the basis of any definite conclusions; two or three additional years will be required in order to check properly on the results.

Fertilizer Tests with Tomatoes, 1921.—Variety used, Globe. Seed planted January 17th, in glass-covered, fire-heated hotbed. Tomato plants grew rather slowly, and were transplanted to cold-frame March 17th; to field, April 15th. Rains and cold weather followed planting. Frost caused a check in growth, April 18th, temperature down to 37 F.

Rows in fertilizer plat are seven feet apart; each row is a plat. Between each plat, a narrow sod takes the place of intervening rows, serves to separate the fertilizer plats, prevents washing, and facilitates harvesting. Fertilizer applied April 7th.

There were not enough plants from the original planting to set the entire plat, so that the last thirty plants on the south end of each row were taken from a planting made in the open field on March 1st.

At the time of the first picking, on June 6th, considerable differences were apparent in growth and early yield, in favor of the fertilizer plats with balanced fertilizer applications.

In the following table, the amounts of fertilizer are given in pounds per acre basis. The yield record included here is up to June 24th only. Unless otherwise stated, Nitrate of Soda is the source of Nitrogen in all the fertilizer work.

Plat No.	Fertilizer	No. of 20 lb. Crates per A.
1	500 lb. 8:4.6:7	106¾
2	500 lb. 8:5:0	70
3	Check	38½
4	1000 lb. 8:5:0	73½
5	166 2/3 lb. Nitrate Soda	67½
6	Check	49
7	227½ lb. Dried Blood	43¾
8	16 T. Manure	101½
9	Check	54¼
10	250 lb. Acid Phosphate	57¾
11	70 lb. Sulphate Potash	31½
12	Check	45½

The land used for these tests had been in corn and velvet beans two years with the velvet beans grazed off by cattle in the winter.

Subtracting the cost of the fertilizer and applying gives a balance of Seventy dollars per acre in favor of Plat 1 over average of the check plats. Crate of tomatoes figured at $1.35 each, the f. o. b. price June 24th.

Sweet Potato Fertilizer Record. 1921.

Eight hundred lbs. of each fertilizer combination applied per acre. The plants were set 15 inches by 3½ ft. Yields given below in bushels per acre, figured at 60 lbs. per bushel for green potatoes.

The crop was grown from cuttings, set June 23rd, harvested November 24th, five months. Fertilizer applied June 22d.

The tabular record follows. Results are without value for this first year. Every precaution, however, was taken to get every potato out of the ground, and to get accurate weights of all grades. The only piece of land suitable for this fertilizer work has been in corn and velvet beans the two years preceding (and velvet beans grazed off by cattle in the winter), so that a period of five years may be necessary to get any definite results as to fertilizer requirements for this crop.

Sweet Potato Fertilizer Data.—Yields given in 60 lb. bushels per acre.

Plat No.	Fertilizer Mixture	Marketable Potatoes	Culls	Total
1	8:3:0	331¼	64½	395¾
2	8:3:3	345¼	55	400¼
3	8:3:6	369	56½	425½
4	Check	306¼	47	353¼
5	8:3:9	307	84¼	391¼
6	4:3:6	311¼	53¾	365
7	0:3:6	330½	80½	411
8	Check	326½	52½	379
9	8:0:6	295	17	312
10	8:6:6	307½	64	371½
	Nitrate Soda used			
11	8:6:6	380	70	450
	Dried Blood used			
12	500 lb. Nitrate Soda	350	63¾	413¾

No cracking of potatoes was seen in Plat 12 where Nitrate of Soda was used alone; none of the plats showed cracked potatoes, as is sometimes seen in potato patches in this section.

Unless stated otherwise, Nitrate of Soda is the source of Nitrogen, Acid Phosphate for phosphorus, Sulphate of Potash for potash. These same sources were used for fertilizers in tomato work unless stated otherwise.

The yields of sweet potatoes in the fertilizer plats are considerably higher than for the variety tests. However, the variety plats were not set out until July 8th, and draws used instead of cuttings which are used for the fertilizer work. Also the plot for the variety tests is a poorer piece of ground, being on a hillside, with the soil noticeably thinner.

III. Variety Tests of Fruits and Vegetables, Including Tests of New Plant Introductions.

The greater proportion of requests for information from the Horticultural Division of the Experiment Station, relate to best varieties of fruits and vegetables for South Mississippi. Consequently, more land and attention have been devoted to this line of investigation.

Variety Tests of Fruits.—The following kinds of fruits were planted in December, 1920, and January and February of 1921.

Deciduous Tree Fruits: Peach, plum, apple, pear, pecan, Japanese persimmon, fig, quince, almond, and apricot.

Citrus Fruits: Satsuma orange, kumquat, grapefruit, and tangelo.

Grapes: Vinifera or European grapes (Vitis Vinifera); the northern bunch grape, such as Concord; and varieties of Vitis Rotundifolia of the southern muscadines.

Bush Fruits: Raspberry, blackberry, dewberry, and blueberry.

Varieties of strawberries.

All the fruits mentioned above have done exceptionally well during this past season. They have made a large growth, though excessive amounts of fertilizer have not been used. Commercial practice has been closely adhered to in their culture. Continuous clean cultivation is the factor given a vigorous, uninterrupted growth, without which, fertilizer applications prove of but little value. The varieties of peaches, especially Early Rose, have set fruit buds heavily, and the average height of the trees from five to six feet. The fig trees ripened a number of fruits in October and November, though considerably out of season for this fruit.

The experiment in co-operation with the U. S. Department of Agriculture with four varieties of Vitis Vinifera grafted on four different stocks, making sixteen combinations, was a failure. The grafts were not received until May 3rd, during a hot season. While every planting precaution was observed, not a one of the single bud cions pushed into growth. The experiment, with some additions, will be repeated this year, but the grafts will be planted during the winter.

The strawberries have been grown for plants only, in order to get uniformity in starting the variety tests. Seven varieties, Klondyke, Aroma, Gandy, Missionary, Premier, Progressive, and Lady Thompson, were carried through the summer, and the new plants were transferred on November 30th, to the new location. All the varieties except Premier made an abundant supply of plants.

Variety Tests of Vegetables.—The variety test of tomatoes was done in co-operation with Mr. D. C. Neal, Plant Pathologist of the A. & M. College Experiment Station. Four varieties which had formerly been selected for Fusarium wilt resistance were checked against four standard commercial varieties. The results are given in tabular form herewith:

The wilt-resistant varieties are the first four named:

Variety	Pounds of Nos. 1 and 2	No. of Plants Dead from Wilt (August 24)
Narduke	61.6	9
Marvel	73.5	15
Columbia	80	13
Norton	123.5	9
Beauty	54	16
Stone	21	24
Globe	37	8
Bonny Best	102	8

The soil in the plant bed was inoculated with the Fusarium Wilt Fungus, and on transplanting to field March 31st, soil from the plant bed was scattered in the furrows made for the plants. No marked difference in these varieties was evident this year, but the accumulation of wilt fungus in the soil will likely cause more damage next season. The first picking of tomatoes was made June 20th, the last on August 24th.

Preliminary variety tests to form a basis for varietal selection and cultural practices, were made on cantaloupes, cucumbers, green beans, watermelons, cabbage and cauliflower. From these tests, varietal selection work will be done next year on the Pollock 25 Cantaloupe, Irish Grey Watermelon and Early Fortune Cucumber. Cultural practice will be made with Gilt Edge Cauliflower, Early Jersey Wakefield Cabbage, and Red Valentine Bean.

The test of sweet potato varieties was made on Triumph, Nancy Hall and Porto Rican. The plants were sent from Holly Springs Experiment Station, and were set July 8th, during rainy season; spaced 15 inches by four feet. These were dug November 25th, before frost. Figuring the green potatoes at 60 pounds per bushel, yields per acre were as follows:

Variety	Grade 1 and 2	Grade 3	Total
Porto Rican	120	35	155
Triumph	87½	26	113½
Nancy Hall	72½	41	113½

Seed has been saved from these variety rows, and these tests will be repeated with an early start of plants.

New Plant Introductions from the United States Department of Agriculture, were received and tested with following results to date:

S. P. I. No. 48550—**Solanum sp.** Died.

S. P. I. No. 45751—**Solanum Bullatum.** From Brazil, claimed to be very high in protein feed content for stock. The two plants of this species grew eight feet high, blossomed, and seed balls ripened. Each seed ball contains numerous seed like those of **Solanum tuberosum.**

S. P. I. No. 46664—**Allium Cepa.** Two plants from China—still thriving, value not tested yet.

S. P. I. No. 45023—**Solanum Tuberosum.** A variety of potato from Hawaii, claimed to be resistant to blight and wilt. One tuber received made into six cuttings, producing a total of 20 tubers. Three of these were prepared for the table, and the quality is excellent. The skin of the tubers is purple in color. The foliage remains green and vigorous up to digging time. The tubers are being preserved for planting next Spring.

Fifty plants of **Parthenium Argentatum** were received from Mr. Geo. E. Murrell, Horticulturist of the Southern Railway. This plant is Mexican in origin, and is valuable as a source of resin. Five of the plants lived and flowered, and flower heads with seed have been saved for subsequent planting.

IV. Cultural Practices.

Experiments in Pruning.—This is a study of the growth and performance of peach trees as affected by summer pruning exclusively, winter pruning exclusively, and a combination of summer and winter pruning. Pruning as usually practiced in the dormant period of a tree's life, implies the extensive removal of wood growth which has been formed during the preceding growing season. The amount of wood varies, but often amounts to about one-half. Better results from pruning in this climate may be possible by removing undesirable branch growth as soon as it appears, and by checking the rapid growth of the framework limbs by pinching the tips. It is the purpose of this study to ascertain the effect of such a procedure under our climatic conditions.

The plans noted above have been done on two vatieties of peaches, Early Rose and Slappy. At the time of setting out the trees, which were all of the 12–18 inch grade June Bud Whips, all the tips were cut off. One portion of the trees have been summer pruned, cutting some back to three framework branches, and others to four and five. At the time growth started in the spring, records were made of the diameter of each tree trunk. The branch tips of the summer pruned trees were cut off after the limbs were two feet long and laterals forced into growth. Following this, these laterals were thinned to three and four on each scaffold branch. Since the trees at this date (Dec. 1st) still retain their foliage no total growth records have been made, to compare the summer pruned trees with the check trees. This work will be continued, and results noted on yields of the trees especially.

Sod Culture vs. Clean Culture of Figs, Peaches, and Satsuma Oranges.—The objects of this line of work include the study of **nematode** or root-knot injury on figs and peaches, control of erosion of the land and the most profitable methods of operating orchards in the Long Leaf Pine Soil Belt.

Figs.—Variety used, Celeste. Twelve trees per row. One row has been maintained in continuous clean culture, except for a fall cover crop of peas. The adjacent row has been allowed to sod, with the grass kept closely mowed. Growth records on these two plats have not been made at this date, but the total lineal growth of the clean culture plat is from ten to twenty times as great as the sod trees. All plats in this work receive the same fertilizer treatment. Next spring both plats will be plowed with a turning plow, and only one-half of the sod plat will be allowed to grow grass. The remaining half will be kept clean of grass, as the case with fig trees in a poultry yard, but not cultivated.

From a commercial standpoint fig culture has not proven profitable east of the Mississippi River. Given back yard conditions, or if allowed to grow in a poultry yard, the fig is very productive. With the demand for this fruit from the canning factories in this State, a successful method of commercial production will give the basis for a valuable industry.

With peaches, two varieties have been used, Elberta and Hiley. Four plats are used, one permanent sod of carpet grass, one permanent clean culture, and two plats where sod and clean culture alternate annually. The difference in growth between the sod trees and the cultivated trees is very marked, as would be expected. Subsequent data on yields, profit and longevity of the

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trees, however, may give some valuable information on **nematode** control combined with profitable orchard management on the rolling lands of South Mississippi.

The work on Satsuma Oranges is identical with that of the peaches, with the exception that the **Citrus Trifoliata** stock of the Satsuma is immune to **nematode** injury.

Hill vs. Matted Row System of Strawberry Culture.—Variety used, Klondyke. Planted November 30th, 1921. Seven rows in each plat, 120 feet long. Rows 3½ feet apart. Annual, hill plat, plants 12 inches in the row. Matted row plat, 30 inches in the row. Same fertilizer treatment will be given to both plats, and cost of production, and yield records obtained.

V. Experiments in Storage of Sweet Potatoes.

The sweet potato storage house on the Experiment Station Grounds is of standard construction, 20 ft. by 20 ft., ten foot wall, capacity about 1,000 bu. in crates. Storage records were maintained on 50 bushels of Nancy Hall potatoes last winter, 1920-1921. The remainder of the crop had to be dug before the storage house was completed. Only one-fourth of one per cent of these potatoes were affected with soft rot. For all practical purposes, perfect storage resulted.

This year 100 crates of Nancy Halls have been placed in storage for definite records. Accurate weights to determine exact percentage of shrinkage have been made on one lot of potatoes. All the expenses of storage are being kept, including this shrinkage, to compare the net results of storage with the method of selling the green crop direct from the field to the canning factory or other outlets.

Oak wood is used to heat the house. Coal is better because of more even heating, but coal was not obtainable.

The All-Year Home Garden was started as a definite project Oct. 14th, 1921. The trial winter garden of 1920-1921 attracted such favorable attention, and was so successful that definite data should be obtained. On the date mentioned, the following vegetables were planted, as listed in the following rough classification: Salad crops: Lettuce, endive, parsley, corn salad. Root crops: Radish, turnip, rutabaga, parsnip, carrot, salsify, kohlrabi, onions. Greens: Mustard, spinach, kale, cabbage, Brussells sprouts. Miscellaneous: English peas, cauliflower, Brocoli.

Every row in this garden is to be kept busy the entire year. Planting dates, harvesting, and varietal records are being maintained.

Bulletin No. 202 December 1921

Report From

Holly Springs Branch Experiment Station For 1921

By
C. T. AMES

Corn planted in 5½ foot rows with one row of O-too-tan Soy Beans planted between each row of corn. See report of Corn and Bean Test.

Mississippi Agricultural Experiment Station,
Agricultural College, Mississippi
J. R. RICKS, Director

STATION STAFF.

D. C. Hull, M. Sc.....President of College
J. R. Ricks, M. Sc.....Director
H. B. Brown, Ph. D..... Plant Breeder, Vice-Director, Chief in Agronomy
E. B. Ferris, M. Sc.....Assistant Director, South Mississippi Branch Station
C. T. Ames, B. Sc.....Assistant Director, Holly Springs Branch Station
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D. C. Neal, B. Sc. M. A.....Plant Pathologist
..... Dairyman
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R. N. Lobdell, M. Sc.....Entomologist
W. E. Ayres, B. Sc., M. Sc. .....Plant Breeder, Delta Branch Station
H. F. Wallace, B. Sc.....Assistant at Holly Springs Branch Station
F. B. Richardson, B. Sc.....Horticulturist, South Miss. Branch Station
M. E. Andrews, M. S. A.....Associate in Farm Management
F. M. Herzer, B. Sc.....Associate Dairyman
A. C. Walthall.....Agricultural Editor
H. H. Harned, M. S.....Assistant Bacteriologist
Miss Kittie Sue Johnson, A. B.....Stenographer and Clerk
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B. V. Evans.....Farm Foreman, South Miss. Branch Station
J. C. Ryan.....Farm Foreman, Holly Springs Branch Station
I. P. Trotter, B. Sc.....Farm Foreman, Delta Branch Station
D. Maxwell.....Foreman, Horse and Beef Farms

*In cooperation Bureau of Animal Industry, U. S. Department of Agriculture.

Report from Holly Springs Branch Experiment Station for 1921

INTRODUCTION

This Bulletin contains a report of the year's work. Results of some of the projects are incomplete and a full report could not be made at this time. Experiments with Irish potatoes and tomatoes were not thought of sufficient value to publish on account of the unsatisfactory seasons of the past year. Special attention has been given to soil improvement, cotton and corn variety studies, spacing tests with cotton, cultural methods with cotton and corn, fertilizer studies with cotton and corn, crop rotation as practical on the Station, variety test with alfalfa, grasses and clovers, forage crops and permanent pastures, lime studies and cooperative fertilizer tests.

EROSION

It will be only necessary for one to travel through Central and Northern Mississippi to understand the importance of this subject; to see the once fertile hills now in many cases a barren waste. Red gullies from five to twenty feet deep are on thousands of acres, that the first settlers of this country selected as the most choice part of the State. Had thsse lands been properly terraced when cleared, the steep hills sodded to bermuda grass for livestock and the soil fertility maintained by growing legumes or restorative crops on the more cultivatable parts, these lands would now be the garden spot of these United States. As a proof of this statement, where fertile soils are now found in this section any thing that will grow in this climate does better here than almost anywhere. Cotton, corn, lespedeza, clovers, alfalfa, wheat and all kinds of grain, livestock, Bermuda grass and all kinds of grasses, apples, peaches, plums, grapes and all kinds of fruit, and strawberries do remarkably well. There are apple trees seventy-five years old on many farms in this section that have had but little attention and are still producing large crops each year. There is no better trucking soil on earth than the fertile soils of the Brown Loam area.

The one crop system, the credit system, cheap lands, the absent and large land owner, but few terraces to check washing, the negro tenant who backs off when a gully starts and allows it to grow larger, the use of fire in many instances to destroy vegetation that should be turned into the soil to assist in keeping up soil fertility, not enough livestock for the farm and the "IG-NO-RANCE" of all of nature's laws can easily account for the present conditions.

The remarkable thing of it all is that in spite of the teachings of all the agricultural institutions of the country,—the banker, credit merchant, landlord and other business men of the State have sat in their places of business and apparently have never seen that practically every dollar

of the wealth of this State comes from the soil in crops and timber. There are no mines, but few factories and but comparatively few farms that are not getting poorer each year. The timber is rapidly being removed from the land. When the farm fails, the railroad fails, and all business fails. The laws of nature have been violated and the inhabitants of the land will pay the penalty in poor crops, less business, poor schools, sorry roads and not in the highest type of citizenship. "The end is not yet." Some of the business men of Memphis and other cities have "seen a vision and dreamed dreams." The 1920 State Legislature had a vision. The business man will have to get behind the teachings of agricultural institutions and assist these institutions in establishing a safe and sane system of farming on every farm and in maintaining farm fertility, also, in assisting the farmer in getting the best price to be had for all farm products and be content in taking toll on what the farmer buys. Promote agriculture in every way. Get behind all agricultural work in the State and the county. See that the boy and the girl are taught agriculture and business methods in every way possible for through this source is the hope of the future. There are enough men in each county in the State that have sufficient knowledge, or could be easily taught, to lay off terraces on every farm in one season. There is enough idle labor and work stock on every farm to terrace the farm between the time one crop is harvested and the time to plant the next. The watchword should be, stop the land from washing, a legume between every row of corn, live-stock on all idle land,—but not more than the farm demands—plenty of forage and feed for man and livestock, then in most instances, all the cotton that can be grown. If every row of corn grown in the State was 5½ or 6 feet wide with the same number of stalks per acre as on narrow rows and a heavy growing legume planted between each row of corn, it would not be five years before these lands would double the present yields. But few if any lands respond as quickly to good treatment as the Brown Loam.

This station has proven that land can be terraced for $1.00 per acre for labor only, that the once gullied lands can be reclaimed and brought back to producing paying crops, that the broad shallow terrace and winter cover crops will reduce soil washing to a minimum and that these soils can be built up cheaply and gradually increase in yields.

Bulletin No. 165 from this Station discusses terraces, how to make them etc., and can be had free from the Experiment Station, Agricultural College, Mississippi.

VALLEY LAND VARIETY TEST WITH COTTON 1921.

Soil.—Valley land used in two year rotation with vetch as the legume.

Plots.—One row each repeated four times, making 1/23 acre per plot. Rows 3½ feet wide, plants 10 inches in the row.

Fertilizer.—A mixture of 200 lbs. acid phosphate and 100 lbs. cottonseed meal was used per acre.

Date of Planting.—April 30th. It was necessary to do some replanting by hand.

TABLE NO. 1. VARIETY COTTON—VALLEY LAND TEST.—1921.

Number	VARIETY USED	Dates of Picking		Total Plot Yield	Total Yield Seed Cotton Per Acre	Lint Per Cent	Pounds of Lint Per Acre	Length of Lint	Value of Lint Per Pound	Value of Lint	Pounds of Seed Per Acre	Value of Seed at $25 Per Ton	Total Money Value Per Acre	Rank in Money Value
		Sept 10	Oct. 4											
1	Simpkin's Ideal	42.5	64.5	107.0	2466.1	35.3	870.5	⅝	.14	$121.87	1595.6	$19.94	$141.81	22
2	Trice 270-41	65.0	35.0	100.0	2304.8	29.3	675.3	1⅛	.24½	165.35	1629.5	20.38	185.73	14
3	Wannamaker-Cleveland	56.5	51.5	108.0	2489.2	34.9	868.7	⅝	.14	121.62	1620.5	20.25	141.87	21
4	Cleveland 34-W-54	58.5	50.5	109.0	2512.2	33.8	849.1	⅞	.16	135.86	1663.1	20.79	156.65	16
5	Piedmont-Cleveland	49.0	55.0	104.0	2397.0	33.7	807.8	⅞	.16½	133.29	1589.2	19.86	143.15	19
6	Cleveland Big Boll	43.5	51.0	94.5	2178.0	32.8	714.4	⅞	.16½	117.88	1463.6	18.30	136.18	23
7	Cook's 1010	55.0	45.0	100.0	2304.8	38.7	892.0	⅝	.14	124.88	1412.8	17.65	142.53	20
8	Half and Half	57.0	42.0	99.0	2281.8	41.0	935.5	⅝	.14	130.97	1346.3	16.83	147.80	18
9	Miller	40.0	71.0	111.0	2558.3	31.4	803.3	1	,16	128.53	1755.0	21.94	150.47	17
10	Triumph	21.0	48.0	69.0	1590.3	36.1	574.1	⅞	.16½	94.73	1016.2	12.70	107.43	25
11	Lone Star (Ferguson)	28.5	71.0	99.5	2293.3	33.5	768.3	1 1-16	.23	176.71	1526.0	19.06	195.77	11
12	Lone Star 11-65	56.5	44.0	100.5	2316.3	32.0	741.2	1 3-16-1 ¼	.28	207.54	1575.1	19.69	227.23	5
13	Acala No. 5	47.0	43.5	90.5	2085.8	34.4	717.5	1 1-16-1 ⅛	.22½	161.44	1368.3	17.10	178.54	15
14	D. & P. L. No. 1	52.5	56.5	109.0	2512.2	30.3	763.7	1 ⅛-1 3-16	.25½	194.74	1748.5	21.86	216.60	6
15	Express 432	58.0	45.0	103.0	2373.9	30.9	733.5	1⅛	.24	176.04	1640.4	20.59	196.54	10
16	Express 432-782	56.0	45.0	101.0	2327.8	30.0	698.3	1-⅛-1 3-16	.27	188.54	1629.5	20.38	208.92	7
17	Express 433	55.0	49.0	104.0	2397.0	26.6	637.6	1 3-16	.27	172.15	1759.4	22.00	194.15	12
18	Express 350-718	61.0	44.0	105.0	2420.0	27.6	667.9	1 3-16-1 ¼	.28	187.01	1752.1	21.90	208.91	8
19	Delfos 6102	62.5	48.0	110.5	2546.8	31.3	797.1	1 3-16-1 ¼	.28	223.19	1749.7	21.87	245.06	2
20	Delfos 631	53.0	41.0	94.5	2178.0	31.4	683.9	1 3-16-1 ¼	.31	212.01	1494.1	18.68	230.69	4
21	Sunpress 61	43.0	42.0	96.0	2212.6	25.4	562.0	1 ¼-1 5-16	.32	179.84	1650.6	20.64	200.48	9
22	Webber 49	35.5	44.5	80.0	1843.8	28.1	518.1	1⅛	.34	176.15	1325.7	16.58	192.73	13
23	Webber 82	32.5	60.0	92.5	2131.9	31.3	667.3	1¼	.33	220.21	1464.6	18.31	238.52	3
24	Bank Account	55.0	37.0	92.0	2120.4	32.2	682.8	⅝	.14	95.59	1437.6	17.98	113.57	24
25	Trice X Triumph F3-82	40.5	64.5	105.0	2420.0	33.1	801.0	1 3-16-1 ¼	.30	240.30	1619.0	20.24	260.54	1

Remarks.—The weather was very wet at the proper planting season and dry during the seed germination period. Only a fair stand was secured. Miller variety had an exceptional good stand and the yield was above the average for that variety on valley land. However the growing season was longer than common. Triumph stand was not so good. The yield is below the average for this variety. The soil on which these plots are located produced two bales of cotton per acre seven years ago. Vetch has followed every other year each cotton crop. Under favorable conditions and no weevil, there is enough fertility in this soil to produce more than two bales of cotton per acre. The boll weevil did considerable damage to the crop during the latter part of the season.

Conclusion.—Before the war practically all of the short staple variety headed the list in money value. During and since the war the staple varieties have taken the lead. As to the variety to grow next year, that will depend upon the difference in price per pound between short and staple cotton. As a rule plant cotton that will pull from 1 inch to 1 1-16 inch; that is what the hill section should grow. There is too much pressure being brought to bear in the cotton world to continue the growing of 5-8 inch staple. This is the first year we have had Wannamaker-Cleveland and Bank Account placed in that class. Fourteen cents is the price used in the 5-8 inch class estimate. This wide difference may be expected in the future if signs that point that way are true.

HILL LAND VARIETY COTTON TEST 1921.

Soil.—Brown loam table land on which soy beans grew the year before and on which ten tons of stable manure, per acre, was applied in the spring of 1921.

Plots.—One row each repeated four times, and 1/31.11 of an acre each. Plants 10 inches apart in the row.

Date of planting.—May 7th it was necessary to replant by hand.

Fertilizer.—Acid phosphate 200 lbs. and 100 lbs. cottonseed meal was applied per acre.

TABLE NO. 2. VARIETY COTTON—HILL LAND TEST.—1921.

Number	VARIETY USED	Dates of Picking		Total Plot Yield	Total Yield Seed Cotton Per Acre	Lint Per Cent	Pounds of Lint Per Acre	Length of Lint	Value of Lint Per Pound	Value of Lint	Pounds of Seed Per Acre	Value of Seed at $25 Per Ton	Total Money Value Per Acre	Rank in Money Value
		Sept. 15	Oct. 11											
1	Simpkin's Ideal	41.0	11.0	52.0	1617.9	35.3	571.1	⅝	.14	$ 79.95	1046.8	13.09	$ 93.04	21
2	Trice 270.41	42.5	5.5	48.0	1493.5	29.3	437.6	1⅛	.24½	107.21	1055.9	13.20	120.41	15
3	Wannamaker-Cleveland	42.0	6.5	48.5	1509.0	34.9	526.6	⅝	.14	73.72	982.4	12.28	86.00	23
4	Cleveland 37-W-54	49.5	7.0	54.5	1695.7	33.8	573.1	⅞	.16	91.70	1122.6	14.04	105.74	18
5	Piedmont-Cleveland	49. 5	7.0	56.5	1757.9	33.7	592.4	⅞	.16½	97.75	1165.5	14.58	112.33	16
6	Cleveland Big Boll	34.5	9.5	44.0	1368.9	32.8	449.0	⅞	.16½	74.09	919.9	11.50	85.59	24
7	Cook's 1010	47.0	9.5	56.5	1757.9	39.7	680.3	⅝	.14	95.24	1077.6	13.48	108.72	17
8	Half and Half	41.0	7.0	48.0	1493.5	41.0	612.3	⅝	.14	85.72	881.2	11.01	96.73	19
9	Miller	41.5	9.0	50.5	1571.3	31.4	493.4	1	.15	78.94	1077.9	13.48	92.42	22
10	Triumph	34.5	11.5	46.0	1431.2	36.1	516.7	⅞	.16½	85.26	914.5	11.44	96.70	20
11	Lone Star (Ferguson)	39.5	12.0	51.5	1602.4	33.5	536.8	1 1-16	.23	123.46	1065.6	13.33	136.79	9
12	Lone Star 11-65	41.5	5.5	47.0	1462.4	32.0	468.0	1 3-16-1 ¼	.28	131.04	994.4	13.44	144.48	5
13	Acala No. 5	41.5	5.0	46.5	1446.8	34.4	497.7	1 1-16-1 ⅛	.22½	111.98	949.1	11.86	123.84	13
14	D. & P. L. Co. No. 1	46.5	6.5	53.0	1649.0	30.4	501.3	1 ⅛-1 3-16	.25½	127.83	1147.7	14.35	142.18	6
15	Express 432	44.5	6.5	51.0	1586.8	30.9	490.3	1⅛	.24	117.67	1096.5	13.71	131.38	11
16	Express 432-782	39 5	10.5	50.0	1555.7	30.0	466.7	1 ⅛-1 3-16	.27	126.01	1089.0	13.61	139.62	8
17	Express 433	43.0	6.5	49.5	1540.1	26.6	399.7	1 3-16	.27	107.92	1140.4	14.25	122.17	14
18	Express 350-718	42 0	6.5	48.5	1509.0	27.6	416.5	1 3-16-1 ¼	.28	116.62	1092.5	12.66	130.28	12
19	Delfos 6102	46.0	4.5	50.5	1571.3	31.3	491.8	1 3-16-1 ¼	.28	137.61	1079.5	13.49	151.10	4
20	Delfos 631	49.5	5.5	50.0	1555.7	31.4	488.5	1 3-16-1 ¼	.31	151.44	1067.2	13.34	164.78	3
21	Sunpdess 61	54.5	4.5	48.0	1493.5	25.4	379.2	1 ¼-1 5-16	.32	121.34	1114.3	13.93	135.27	10
22	Webber 49	38 5	4.4	43.0	1337.9	28.1	375.9	1¼	.34	127.81	962.0	12.03	139.84	7
23	Webber 82	44.0	6.5	50.5	1571.3	31.3	491.8	1¼	.33	162.29	1079.5	13.49	175.78	1
24	Bank Account	44.0	4.5	48.5	1509.9	32.2	486.2	⅝	.14	68.07	1023.7	12.80	80.87	25
25	Trice X Triumph F3-82	42.0	7.5	49.5	1540.1	33.1	509.8	1 3-16-1 ¼	.30	152.94	1030.3	12.88	165.82	2

Remarks.—A rather poor stand was secured. The boll weevil appeared June 28th. The infestation gradually increased until September after which all squares were destroyed. This is the first year this section has been infested with weevil that hibernated here. In the fall of 1916 this section had migratory weevils in a small quantity. The hard winter that followed killed them.

Poisoning the Weevil.—Mr. T. F. McGehee, of the State Plant Board conducted some poisoning experiments on sections of both hill and valley plantings using lead arsenate applied with a hand machine. An application was made every seven days. After three or four applications it was thought the infestation was too light to continue, so the work was dropped. Practically no increase in yields of cotton was obtained on any of the plots poisoned. Calcium arsenate should be used as there is a larger per cent of soluble arsenic in this form of the poison.

It is the general opinion that the use of calcium arsenate can be used to profit for poisoning the boll weevil where large areas of land are seeded to cotton and when only applied on the infested parts of the field. Where small areas are planted to cotton and there are many places nearby where the weevil can spend the winter, poisoning has not been found profitable.

Varieties for Hill Land.—D. P. & L. Co. No. 1, Lone Star (Ferguson), Webber 49, Cleveland 37-W-54, Piedmont-Cleveland, Cleveland Big Boll and Miller. No seed available of TriceXTriumph F3-82.

Varieties for Valley Land.—Lone Star 1165, D. P. & L. Co. No. 1, Trice 270-41, Express 350-718, Piedmont-Cleveland, Cleveland 37-W-54. It will be noticed we have made many changes in our recommendations, we are basing same on our results. It should also be noticed the wide range in prices from 14 to 34 cents per pound. Also that there are not many real cotton markets in the State. The country will come to this later.

FERTILIZER TEST WITH COTTON 1921.

Soil.—Brown Loam Valley Land, which had been in Bermuda and Lespedeza pasture for fourteen years prior to its use in this Fertilizer Test in 1920.

Plots.—Four rows each, 3½ feet wide and 72 feet long, making 1/43.21 of an acre each. Record was only taken from the two inside rows. Every third plot was a check or no fertilizer plot. Most of the plantings were in duplicate, as can be seen in the table below.

Planted.—May 3rd, some replanting by hand. An attempt was made to space the cotton 10 inches in the row.

Variety Planted.—Trice 270-41.

TABLE No. 3—FERTILIZER TEST WITH COTTON, 1921

FERTILIZER USED	Yield of Seed Cotton Per Acre Series 1.	Increase Over Checks Per Acre	Yield of Seed Cotton Per Acre Series 2	Increase Over Check Per Acre	Increase Average Over Check
200 lbs. Acid Phosphate	1815.0	216.0	2549.7	172.9	194.5
Check	1599.0		2376.8		
400 lbs. Tenn. Phos. Rock	1642.2	43.2	2426.9	50.1	46.7
400 lbs. Fla. Soft Rock	2279.9	32.7	2376.8	70.3	51.5
Check	2247.2		2306.5		
200 lbs. Duplex Phosphate	2424.7	177.5	2440.0	133.5	155.5
100 lbs. Kainit	2679.3	43.2			43.2
Check	2636.1		1685.4		
250 lbs. Cottonseed Meal	2817.9	181.8	1815.0	129.6	155.7
100 lbs. Nitrate of Soda	2233.6	202.5	2017.5	332.1	267.3
Check	2031.1		1685.4		
200 lbs. Tankage	2156.7	125.6			125.6
100 lbs. Cyanamid	2074.3	129.6	2254.0	136.5	133.1
Check	1944.7		2117.5		
75 lbs. Sulphate Ammonia	2007.9	63.2	2181.1	63.6	63.4
50 lbs. Nitrate Ammonia	2170.0	311.8	2350.6	292.6	302.2
Check	1858.2		2058.0		
200 lbs. Dried Blood	2031.1	172.9			172.9
25 lbs. Nitrate Ammonia					
37½ lbs. Sulphate Ammonia	2347.2	27.2	2252.5	194.5	110.9
Check	2320.0		2058.0		
50 lbs. Nitrate Soda			2031.1		
125 lbs. Cottonseed Meal	2506.5	186.5	2217.5	186.4	186.5
50 lbs. Nitrate Soda					
100 lbs. Tankage	2592.9	172.9			172.9
Check	2420.0		1555.7		
Soak Seed in Ni. So. Sol.					
50 lbs. After First Working					
50 lbs. On July 1st	2570.3	150.3	2181.1	625.4	387.9
250 lbs. Cottonseed Meal					
200 lbs. Acid Phosphate	2463.3	229.7	1728.6	172.9	201.3
Check	2233.6		1555.7		
100 lbs. Nitrate Soda					
200 lbs. Acid Phosphate	2347.2	113.6	2017.5	461.8	292.7
200 lbs. Tankage					
200 lbs. Acid Phosphate	2190.4	418.6	1801.5	205.0	311.8
Check	1771.8		1596.5		
50 lbs. Nitrate Soda	2031.1				
37½ lbs. Sulphate Ammonia	2160.8	129.7			129.7
75 lbs. Cyanamid			1844.3		
200 lbs. Acid Phosphate	2320.0	332.1	1771.8	72.5	202.3
Check	1987.9		1944.7		
75 lbs. Sulphate Ammonia					
200 lbs. Acid Phosphate	2174.3	186.4	2117.5	172.8	179.6
200 lbs. Dried Blood					
200 lbs. Acid Phosphate	2422.5	477.8			477.8
Check	1944.7		1555.7		
100 lbs. Nitrate Soda	2465.8				
400 lbs. Tenn. Phos. Rock	2622.5	156.7	1665.9	110.2	133.5
100 lbs. Nitrate Soda					
400 lbs. Fla. Soft Rock	2549.7	83.9	1887.9	332.2	208.1
Check	2465.8		1555.7		
100 lbs. Nitrate Soda					
200 lbs. Duplex Phosphate	2649.7	143.2	1771.8	216.1	179.7
Check	2506.5		1555.7		
100 lbs. Nitrate Soda					
200 lbs. Acid Phosphate					
50 lbs. Kainit	2765.8	259.3	1771.8	175.3	217.3
Check	2506.5		1596.5		

Remarks.—One set of Check Plots was located in a rather low place through the field, hardly noticeable, but evidently has accumulated vegetable matter in years past, enough to overcome fertilizer that was used on the less favored land nearby. This is the only way we can account for the slight difference in fertilizers known to be very beneficial to most lands in this section.

It is very evident that this land would make good cotton without much fertilizer. The stand was very good, just a little wilt in places. The weevil began work with a slight infestation the latter part of June. In September the infestation was so heavy no blooms were seen.

Conclusion.—It is evident that both nitrogen and phosphorus either alone or in combination have given good results. It would appear that a mixture of 200 lbs. acid prosphate and 100 lbs. Nitrate of Soda, or its equivalent in dried blood, tankage and other forms of nitrogen about meets the requirements of such soils. All of the fertilizers were applied under the seed except as otherwise stated in the table. Acid phosphate at the rate of 200 lbs. per acre will hasten the maturity of cotton and on such lands under heavy infestation of weevil will pay.

COTTON SPACING—1921.

Soil.—Red Clay hill land.

Plots.—Six rows each, duplicated.

Fertilizer.—A half and half mixture of Acid Phosphate and Cottonseed Meal applied at the rate of 300 lbs. per acre.

Record was only taken from the four inside rows. Rows 2 and 3½ feet wide and plats equivalent to 1/14.82 of an acre each.

Planted.—April 25, 1921 and replanted May 4, 1921. A poor stand was secured and it was impossible to get the spaces indicated in the test.

TABLE NO. 4.

Variety	Width of Rows	Space in Drill	Yield in lbs. Per Plot	Yield in lbs. Per Acre
Cleveland-Wannamaker	2 Feet	10 Inches	140	2074.8
Cleveland-Wannamaker	3½ Feet	Not Thinned	79¼	1174.5
Cleveland-Wannamaker	3½ Feet	6 Inches	94	1393.1
Cleveland-Wannamaker	3½ Feet	12 Inches	93¾	1389.3
Cleveland-Wannamaker	3½ Feet	18 Inches	86	1274.5
Cleveland-Wannamaker	3½ Feet	24 Inches	83½	1237.5

Remarks:—The two-foot row results should not be taken as conclusive. This is the first test with 2 foot rows. At least two more years will be required to establish what can be expected with such plantings on thin land. It is very evident that larger yields may be expected. It is the number of stalks per acre and not the width of the rows that counts.

Conclusions:—Three foot rows on thin upland and not over 3½ foot rows on valley land and two stalks every 12 inches will give the best yields at present. This is more in line with former experiments than this season's results. The close spacing or crowding checks the growth of the stalk and promotes early fruiting. This method will grow more cotton with or without the boll weevil.

COTTON CULTURE.

Fertilizers.—In the Northern and Hill section of the State, the use of from 200 to 400 pounds of a high grade fertilizer per acre, one that will analyze from 10 to 12% phosphorus and 3 or 4% of nitrogen should be used. Where a lespedeza sod or any large quantity of leguminous crop is turned under, 200 pounds of acid phosphate may be sufficient. A mixture of 200 pounds acid phosphate and 100 pounds nitrate of soda is a fair application of fertilizer for this section on land of ordinary fertility. It will be more necessary in the future to use fertilizer in the Northern Hill Section than it has been in the past on account of maturing the crop earlier as the weevil no doubt will be a factor in the growing of cotton in this section from now on.

Apply all mixed fertilizer before the seed are planted under ordinary conditions. When nitrate of soda is to be used to supply the nitrogen, it may be mixed with acid phosphate and applied before planting the seed, unless there is a heavy infestation of coco grass and in such instances the acid phosphate should be applied under the seed and the nitrate of soda after the cotton has been chopped out.

If cotton seed are soaked a few minutes in a saturated solution of nitrate of soda and water and dried a few days before planting. good results will be obtained. The nitrate of soda crystallizes on the seed and as soon as the seed come in contact with the soil moisture these crystals are dissolved, become available food for the young plants and give them an early start. It only requires one or two pounds of nitrate of soda to treat a bushel of seed which is enough seed to plant an acre.

Preparation and Cultivation.—On account of soil washing during the heavy rains of the winter on rolling land, it is advisable to leave as much vegetable matter as possible on the land. Only where cover crops are to be planted it is advisable to turn the land in the fall unless it is a heavy sod or the soil is properly terraced or surfaced drained. Valley land may be turned in the fall and it will be more profitable to plant such lands to winter cover crops. Soil washing is doing many more times the damage in the State each year than growing the same crop on the land year after year. The broad shallow terrace with a slight fall is the hope of this section. It matters little how your rows run after the land is terraced properly.

Break the land broadcast, disk and harrow, lay off for cotton in 3 or 3½ foot rows, as may be desired, and fertilize. A two row corn planter with a fertilizer attachment is fine for this work. The rows may be covered suf-

ficiently by running a middle breaker between them and the desired elevation secured by the use of a section harrow.

Cotton planting time is around April 20th and from then until early in May. With the boll weevil a factor from now on in the entire State, early planting of early maturing varieties on well fertilized soil, narrow rows, close spacing—6 to 10 inches and frequent (once a week) shallow cultivation is advisable. This should also mean a reduced acreage of cotton in many instances and the growing of more food and forage crops. The farmers in the Northern tier of counties in the State that had the first boll weevil to hibernate in these counties the past winter should understand that he is there to stay and will have to be reckoned with more or less each year as the weather conditions permit. The race each year is on between the weevil and the cotton as to which can multiply the faster. Check the weevil in every way they can be checked and help the cotton in every way known to man. Practice a more sane system of farming.

Co-operative Fertilizer Test.—Late in the spring of 1920, several of the Agricultural High Schools and the Demonstration Agent of Tippah county were visited. The purpose of the visit was to select the soil and put on a simple lime and fertilizer test. All fertilizers and seed were furnished by the Station at a small cost. The seasons were very unfavorable, and as it developed, some of the cotton was planted as late as June 22nd. At the close of the year only one report was worth publishing. That report was made by Mr. Pollard, of Tippah county. This would be most valuable work to put on at each of the Agricultural High Schools and in some instances near the county site. It would give very valuable data to the Stations as to the fertilizer needs of each county and being conducted under the supervision or observation of the schools would bring each student and parent in direct contact with the results. For the work to be successful it will have to be done at the proper time and in the proper way. Closer supervision will have to be given to make the work a success. If necessary to pay a small rental for land and the cost of all labor, so that the person having the work in charge will not be under a handicap. The Branch Station men can assist greatly in this work if undertaken in time to make soil selections and other arrangements without a rush. The planting will have to be supervised as the average agriculturist of these schools usually has his hands full.

Two Year Rotation.—The first requisite to most farms in this section is a stock proof fence, or the enforcement of a twelve month stock law. Many men refuse to grow legumes, either summer or winter, on account of their neighbor's stock being allowed to run at large in the fall after the crops are gathered. Many of the tenants refuse to plant legumes for fear the landlord will increase the rent if the land produces more. If the banker, supply merchant and landlord could get a vision of conditions as they really are, this country would go forward by leaps and bounds. For the reasons given above, a three year rotation is impractical at present. Then a legume every other year will restore more quickly the organic matter so deficient in most soils.

Sow from ten to fifteen pounds of vetch seed, inoculated with soil from a vetch field, in the cotton at the last working. This last cultivation will cover the seed the proper depth. When rains and cool weather of the fall begins,

these seed will germinate. Cotton picking will not damage the planting but little. Allow these plants to mature seed, which is the latter part of May the following spring. After the seed are matured turn the land without removing the hay, harrow and seed to some other crop such as corn. When the land is turned the following spring the bulk of the vetch seed is turned to the surface. Cotton is planted on the land and after cultivation is ended and the arrival of cool, moist fall weather the seed germinate. Allow a portion of these seed to mature in the spring before saving hay or turning the land. If the vetch is allowed to mature seed every other year, a good stand of vetch will be had each fall regardless of the season, wet or dry. We consider this a fool proof method. Vetch may not take hold of your land readily the first year but if persisted in will in a short time do fine. A little stable manure works like magic. We have many acres in vetch that have never been limed or manured and that was as poor a soil as could be found in any man's country, that is growing a good crop of vetch each year. This method will give three crops in two years,—cotton, corn and hay, and each succeeding year each crop produces more. There is the first cost of $1.50 per acre for seed. You can grow more corn planted in June after vetch than you can planted in March not following a legume.

VARIETY CORN TEST—1921.

Soil.—Valley land.

Plots.—One row each, repeated seven times. Rows or checks are 3½ feet apart with two stalks to the hill. Each plot is equal to 1-12.7 of an acre.

Fertilizer.—A mixture of 200 pounds acid phosphate and 200 pounds cottonseed meal was applied per acre.

Planted.—April 29, 1921, and was harvested October 28, 1921.

TABLE NO. 5.

No.	Variety—	Yield in Bus. Shelled Corn Per Acre.	Actual Yield in Pounds Per Plot.	Per Cent of Grain.
1.	Mosby 436 (Ewing)	46.00	243.5	83.3
2.	Cock's Prolific (Delta)	35.78	196.0	80.5
3.	Florida Flint	38.20	216.5	77.8
4.	Cock's Prolific (Station)	39.52	224.0	77.8
5.	Tennessee Red Cob-72	31.63	189.5	73.6
6.	Williamson (Coker's)	33.01	190.5	76.4
7.	Paymaster (Neal's)	43.71	259.0	80.5
8.	Whatley (Prolific)	35.29	207.5	75.0
9.	Laguna (Station)	38.44	215.5	75.0
10.	Marlboro (Wannamaker)	39.29	231.0	75.0
11.	Bigg's 7-Ear	42.17	239.0	77.8
12.	Mosby (Station)	46.55	255.0	80.5
13.	Reed's Yellow Dent	30.21	165.5	80.5
14.	Ellis (Coker's)	41.49	231.0	79.2
15.	Johnson's Prolific (Station)	36.15	198.0	80.5
16.	Paymaster (Harpeth)	46.61	259.5	79.2

Remarks—This is the lowest yield of corn that this land has made in many years. This land grew a heavy crop of crimson clover four years ago. The seasons were unfavorable. Cock's Prolific, Tennessee Red Cob and Mosby (Ewing's) have in the past been our heaviest yielders.

Varieties recommended—Harpeth's Paymaster, Neal's Paymaster, Cook's Prolific, Mosby, Coker's Ellis, Tennessee Red Cob and Ewing's Mosby.

FERTILIZER AND BEAN TEST WITH CORN—1921.

Soil—Clay hill land, slightly rolling and somewhat uneven in fertility.

Planted—May 2, 1921, in 3½ and 5½ foot rows.

Plots—Part of six rows and some with four rows each with same number of stalks per acre as narrow rows, with beans between the rows. Size of plots—1-18.36 of an acre each.

TABLE NO. 6.

NO.	Description of Plots—	Plot Yield in Pounds.	Yield in Bus. per Acre.
1.	6 rows corn and soy beans in same row	44	11.53
2.	Check	47	12.31
3.	6 rows corn and velvet beans in same row, 250 pounds Acid Phosphate	32	8.38
4.	6 rows corn and 250 pounds Acid Phospjhate—	33	8.64
5.	Check	48	12.57
6.	6 rows corn and 50 pounds Nitrate Soda, first Working, 50 lbs Nitrate Soda Head High	49	12.84
7.	6 rows corn and soy beans in same row, 250 pounds Acid Phosphate	27	7.07
8.	Check	30	7.86
9.	6 rows corn and velvet beans in same row, 250 pounds Acid Phosphate	32	8.38
10.	Check	51	13.36
11.	6 rows corn and soy beans in same row	75	19.65
12.	Check	52	13.62
13.	6 rows corn and velvet beans in same row	41	10.74
14.	6 rows corn and 250 lbs Acid Phos. and 100 lbs Nitrate of Soda	102	26.72
15.	Check	66	17.29
16.	6 rows corn and 250 lbs Acid Phosphate	30	7.86
17.	6 rows corn and soy beans in same row	33	8.64
18.	Check	32	8.38
19.	6 rows corn and velvet beans in same row	25	6.55
20.	6 rows corn and 100 lbs Ni. Soda—1st working	61	15.98
21.	4 rows corn and soy beans in middles	60	15.72
22.	Check	47	12.31
23.	4 rows corn and velvet beans in middles, 250 lbs Acid Phos. and 100 lbs Nitrate Soda	98	25.67

NO.	Description of Plots—	Plot Yield in Pounds.	Yield in Bus. per Acre.
24.	6 rows corn and 100 lbs Ni. Soda—1st working	82	21.48
25.	Check	55	14.41
26.	6 rows corn and 50 lbs Nitrate Soda—1st work, 50 lbs Nitrate Soda—Head High	57	14.93
27.	4 rows corn and soy beans in middles, 250 lbs. Acid Phos. and 100 lbs Nitrate of Soda	89	23.31
28.	Check	65	17.03
29.	4 rows corn and velvet beans in middles, 250 lbs. Acid Phos. and 100 lbs Nitrate of Soda	77	20.17
30.	6 rows corn and 250 lbs. Acid Phos. and 100 lbs Nitrate of Soda	105	27.50

Remarks.—The season was very unfavorable, especially for corn on land of this character. Only a fair stand was secured. Plots from 1 to 10 are on the poorest part of the land. The plots were located in the field ten plots wide and three plots long. Plot 11 is a continuation of plot 1, etc. The soil on which these plots were grown was worked probably for 40 years in cotton prior to the establishment of this Station. For the first five years it was grown to lespedeza, it has grown two good crops of crimson clover and had 30 tons of manure per acre added within the past ten years. This soil is properly tile drained and the crop was well cultivated. If the season had been favorable it would have produced more than double the yield of corn. It is a crime not to keep up the supply of organic matter in a soil, so that moisture can be retained by the soil to make a good yield any year.

Conclusions.—Soil deficient in organic matter is a poor place to plant corn. It appears that an application of both acid phosphate and nitrate of soda applied at planting time has given the best results. The growing of beans in the corn reduced the yield of corn but little and should be practiced on all plantings of corn.

CORN AND BEAN TEST.

From results obtained in this test, it is considered advisable to plant velvet beans between the rows after the corn is six to eight inches high, this corn having been planted in 5½ foot rows. Other beans should be planted at the same time as the corn. Where the O-too-tan Soy beans were planted between the rows, this was by far the most promising method and had it not been for the poor stand it would have made the highest yield. This bean was late in maturing and does not shatter out in harvesting. When given space it spreads out and covers the entire middle. (See cut on front page.) Where corn is planted in wide rows (5½ or 6 foot rows) with the same number of stalks per acre as when planted in 3½ foot rows, with a heavy growing legume planted between each row of corn will not lessen the yield of corn but little per acre and will greatly benefit the land. During the past two years this method did not reduce the yield a pound. Such a method should be

adopted in the State. Not a row of corn should be planted without a legume in it or between the rows. If velvet beans were used between the rows of corn on thin land and the O-too-tan Soy Bean or Running Cow Peas, or the Mammoth Yellow Soy Bean on the better classes of soil each year, it would not take five years to double the yield of corn on every acre, provided the soil is prevented from washing. The labor saved in hoeing this corn will more than pay the cost of the beans. This does not take into account the food value of the beans for livestock, which in many instances almost equals the value of the corn.

SWEET POTATO VARIETY TEST—1921.

Soil.—Brown Loam Valley Land.

Plats—Two sets of plats were used in this test. The rows were 3½ feet wide and the plants were 18 inches apart in the row.

Fertilizer.—An equal mixture of cotton-seed meal and acid phosphate, applied before planting, at the rate of 400 pounds per acre.

Dates of Planting.—Plats No. 1. Planted June 8, 1921, after a crop of strawberries was harvested from the land. Area devoted to each variety: 3½ ft. by 280 ft. or 1/44.45 of an acre.

Plats No. 2. Planted June 24, 1921, after a crop of wheat and vetch hay was harvested from the land. Area devoted to each variety: 3½ ft. by 400 ft. or 1/31.11 of an acre.

Preparation of Soil.—The latter part of May after the crops mentioned above were harvested, the land was broken broadcast and thoroughly disked, the rows laid off, fertilized, bedded and harrowed with the section harrow. Before planting, the rows were rebroken and harrowed almost flat.

A perfect stand was secured in both plantings. Cultivation was continued until the vine growth prevented.

TABLE NO. 8.

VARIETY	Yield of Plats No. 1 in Pounds.		Total Yield of Plats Per Acre in Bushels.	Yield of Plats No. 2 in Pounds.		Total Yield of Plats Per Acre in Bushels.
	Marketable	Small		Marketable	Small	
Nancy Hall	230	88	235.6	212	100	161.8
Triumph	334	75	303.0	334	130	240.6
Porto Rican Yam	391	90	356.4	292	96	201.2
Dooley Yam	284	92	278.6	150	85	121.8

Dates of Harvesting.—Plats No. 1 were harvested October 16, 1921.
Plats No. 2 were harvested October 26, 1921.

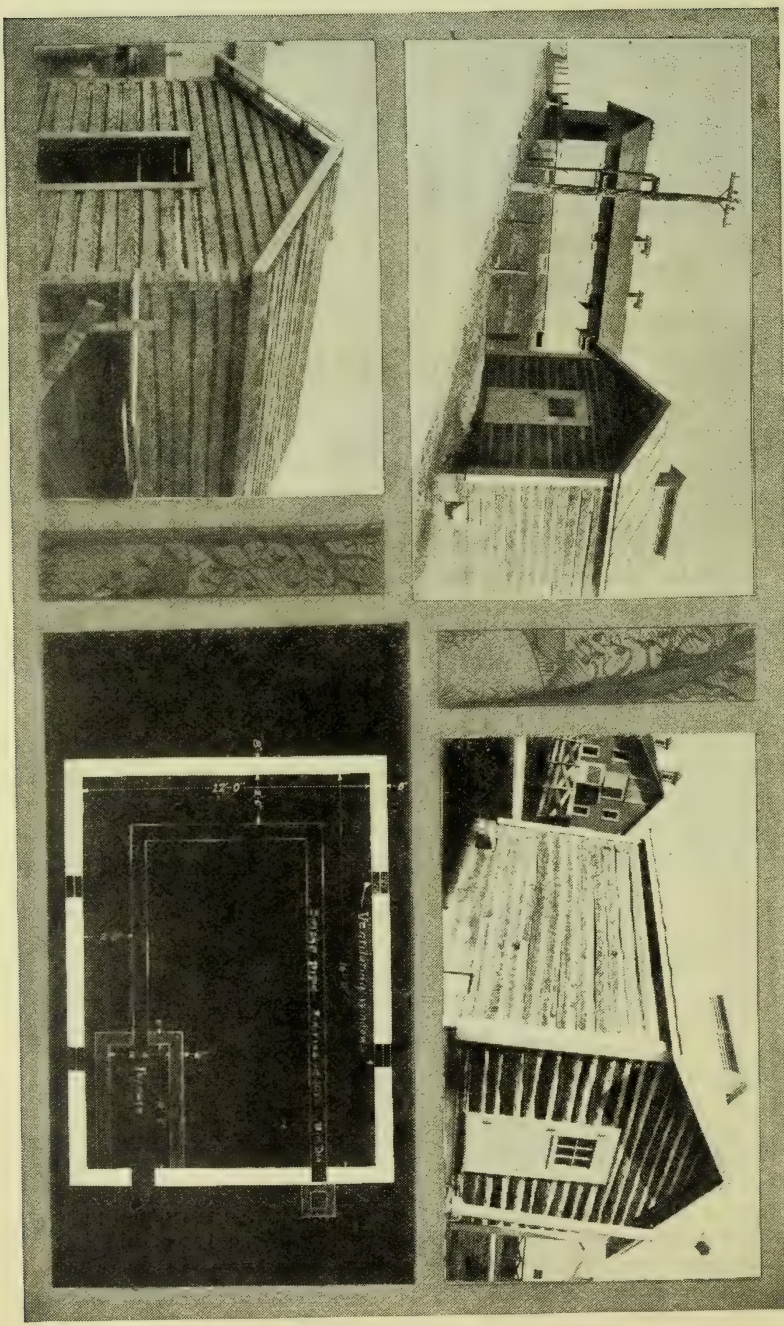
Remarks.—The seasons were more favorable at the start for the first planting and they began growth at once. After the second planting, which is getting late for large yields, the season was not so favorable and the plants were slow in starting growth.

Seed Selection and Treatment.—The potatoes were carefully selected by hand. Only clean potatoes free from disease were used and these were soaked for ten minutes in a solution of Bichloride of Mercury, 1 ounce to 8 gallons of water, to destroy outside infection. It should be remembered that Bichloride is very poisonous when taken internally, but not injurious to the hands or clothes.

Beds—Soil was selected, convenient for watering, on which no potatoes had been grown or bedded for the past ten years. The beds were made five feet wide and the space between each bed was six feet. To give elevation and drainage, about six inches of soil was removed from the center of the walk-way 2½ feet wide and put on the beds. The potatoes were placed close together without touching and covered about 2½ inches deep with woods dirt. Sand would be as good if free from infection. Three varieties, Triumph, Porto Rican Yam and Dooley Yam, were planted from our potato house in which there was some black rot, and absolutely no black rot was found on the bed during the past year. The Nancy Hall potatoes were secured from a distance, supposed to be clean potatoes and were treated in every way as described above. After the first slips were drawn from the bed, the same had to be abandoned on account of black rot. This variety appears to be more susceptible to diseases than the varieties named.

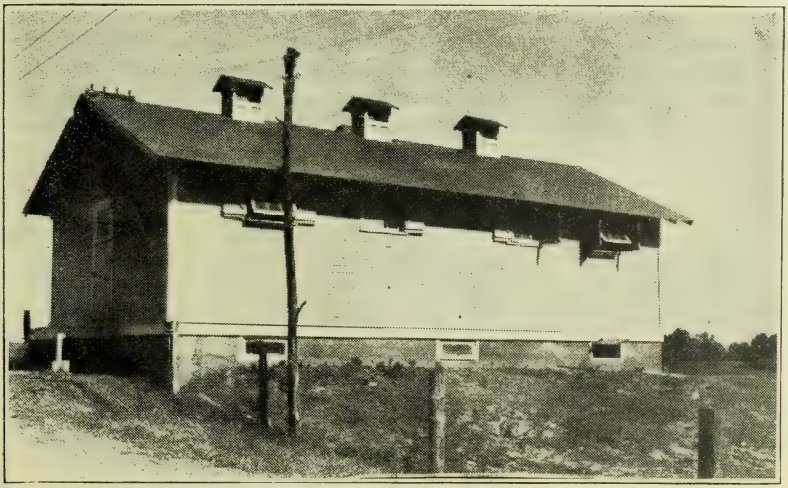
A very successful hot bed heated by fire is in use by many plant growers and is constructed as follows. Soil is selected for the beds as given above on a slightly sloping land and a trench about one spade deep and a little over a spade wide is dug through the center of the bed having a rise of not less than 1 foot in 25 feet. On this trench is placed galvanized iron or old tin and covered over about six inches deep with soil. The lower end of the trench is widened out to act as a furnace in which the fire, when needed, is built. Any kind of stack, a 12 by 12 wooden box six feet high, can be used as a stack to draw the heat and smoke through the covered trench and furnish heat to the potatoes bedded above. The heat is only applied when necessary after cold rains, etc.

The hot bed heated with green stable manure is all right if there is no infection. Stable manure furnishes a fine medium for the growth of many germs and should be used with care. When rotten or infected potatoes have been fed to hogs or stock and this stock allowed the use of the stables and lot, the manure in the stables and lot should not be used in the bed for growing slips or in the field where potatoes are to be planted. It is not known how long this infection will live in the soil but it will be safe to estimate the time to be at least three or four years. If it is necessary to use the hot beds year after year for growing plants, the soil should be removed and all parts of the bed disinfected with a solution of Copper Sulphate. The State Plant Board



is going to put the sweet potato diseases out of this State within a very few years if they can get the co-operation of the people.

Storage Houses.—This Station has an up to date 2500 bushel storage house, the plan of which is furnished to any one in the State desiring the same. The plan is known as the Government Plan.



2500 bushel Potato Storage House.

This is the plan of a small community house estimated to cost about sixty-five cents per bushel for construction under normal conditions. The house has proven very satisfatory and when one of this size or larger is desired we do not know of a better plan. A house should not be built to be used by a community until there is a demand for the same and the growers have a proper knowledge of growing and handling the potatoes. The overhead cost is much less on the farm. With the feeling that the demand at present is for a cheap house or the converting of some out house on the farm into a potato curing house, we have designed a Log Potato Curing House on the order of a tobacco curing house that is, up to this date, proving just as satisfactory in every way and we think has a more desirable heating system than the plan used by the Government House. The House shown in the following cuts is 12 by 16 feet inside measure and is eight feet from the floor to the eaves. It is designed to hold about 450 to 500 bushels. We think a 20 by 20 foot house would be more desirable and would cost but little more when cheap labor is used in getting out the material and in the construction.

The house is built on a concrete foundation eight inches thick which makes it apparently rat proof and averaging about 30 inches in height. It has two 12 by 12 inch ventilators on each side in the concrete foundation but no other side ventilation as may be seen in the cut. The logs are hewn on two sides to six inches in thickness. The floor joists are made of hewn logs

supported through the center by a subsill and rest on the two inch projection of the concrete foundation. A slatted foor of 1 by 4 inch flooring wih cracks about one inch apart is used under the bins and only the walk is floored solid. The heat is applied from underneath the floor from a brick furnace with eight inch galvanized pipe used as a flue and having a rise of about 1 foot to 25 feet from the furnace to the outlet. This flue passes under the center of three bins on the furnace side, across the end and down the center of the bins on the other side to the outlet, where a stack conducts the smoke above the roof, as may be seen in the cut. There are two thicknesses of batten doors at each end of the house, the upper part of the two outside doors are glass to furnish light when necessary on the inside. The logs are built on the sides and ends from the foundation to the comb and are spiked at each end with 60-d nails. The cracks are chinked with wood and cement. Acme plaster may be better. Lime mortar or even mud mixed with straw no doubt would prove satisfactory. The center of the logs on the roof is supported by a set of rafters made of 2 by 6 inch lumber resting on a tie beam. The under side of the logs on the roof is ceiled with rough lumber as it was hard to make the cement mortar stick. The cracks between the logs in the roof were cemented. The roof was covered with galvanized roofing but boards would be satisfactory. This house was constructed at a cost of $150.00 including the purchase of all material and labor. If only the nails, cement, brick, pipe used for flue and lumber are to be purchased, the house should be built for $75.00, not counting labor.

It can be seen that the ventilation and heat has to pass up through the potatoes. A 1 by 6 foot ventilator is made in the comb of the house which may be closed from the inside when necessary. It is much easier to maintain the proper degree of heat in curing the potatoes in this house than in the Government House. This house no doubt will require closer attention during extreme cold weather.

For diseases of the sweet potato and the control of same, write to the Experiment Station, Agricultural College, Miss., for Bullein No. 190, by D. C. Neal.

ALFALFA

This Station now has for distribution from the office of the Experiment Station, Agricultural College, Mississippi, a circular on Alfalfa Culture which can be had free by any one desiring same. Alfalfa will grow on almost any character of soil in this section of the State, if four or five tons of crushed limestone or lime rock shipped from the State Crushing Plants be applied per acre. Only fertile, well drained soils will give satisfactory results. Fertile clay soils have given the best results. The plants on this type of soil giving good yields for about seven years, when on loam valley land four years is about the limit. There is no better grazing crops for hogs and poultry and an acre or more on the farm would be found very desirable. It furnishes grazing during June and July,—two very hard months to furnish such a crop. Close grazing will destroy al-

falfa. To furnish the best results the plants should be clipped as for hay about every thirty days during the season and the hogs kept off for a few days after each cutting.

In the list of varieties we have under study, the Native Grown, Dakota No. 12 and Disco Grimm have shown a little advantage over the others. The seasons have been very unsatisfactory and we still have hope for more definite results this next year.

A Summary of What It Takes to Grow Alfalfa in This Section—A good, fertile, well drained clay soil or good valley land, a well prepared, firm seed bed and a sweet soil, one that has had about four or five tons of crushed limestone per acre. The lime should be applied on top of the last breaking of the soil and mixed nicely with the surface soil by harrowing thoroughly.

A properly inoculated soil is obtained, either by scattering broadcast from 500 to 1000 pounds of soil from an alfalfa or melilotus field and harrowing in, or by using one half pound of soil from an alfalfa field to each pound of seen sown, using glue water on the seed to make the soil stick.

Fall planting is best, the latter part of September to October 15th. If the seasons are not good up to that date, delay planting until spring, say sometime in March. From 20 to 25 pounds of the best seed that can be bought should be used per acre. Sow on top of the soil, if by hand, and cover with a harrow.

LIME.

Three forms of lime have been used:—crushed limestone from ¼" to dust, caustic or air slaked lime, and rotten limestone found in the Eastern and Southern part of the State. Either form is saisfactory. About one-half the amount of caustic lime will give about the same results as twice as much as either of the other two forms named.

As reported in Bulletins 165 and 193, lime will double the tonnage of almost every legume we have grown, lespedeza being the only exception. Two tons of limestone have doubled the yield of soy beans, cow peas, vetch and velvet beans. Red clover will do but little without this amount of lime. Crimson clover, while it will grow without lime, is very much increased by a small application. It is impossible to grow alfalfa without four or five tons additional to the soil. The same amount of money invested in limestone as is necessary to purchase enough acid phosphate (200 lbs.) for one acre of cowpeas, will give about the same results as the phosphate, not for one year but for six or seven years. The proper method is to use the lime first, a few acres at a time, and then the phosphate.

Terraces, lime and legumes will build up these soils and with the addition of livestock, preferably the dairy cow to utilize the legumes, and in no other way can this be accomplished.

GRASSES AND CLOVERS

With only fifteen acres of the farm in valley land many of our tests are confined to thin hill land. These are the lands we think should be used for grazing in most instances. We wish to stress again that thin land, one deficient in organic matter, is a poor place to grow any crop within our knowledge. The basis of successful agriculture is a rich soil. The richer the soil the better the pasture.

On April 10, 1920 the following plots were planted on slightly rolling hill land that had been in pasture for several years. The planting was protected from stock.—Red Clover, White Clover, Italian Rye Grass, Timothy (on both hill and valley land), Red Top, Bermuda, Kentucky Blue Grass, Orchard Grass, Black Medic or Yellow Trifolia, Rhodes Grass, Tall Meadow Oat Grass, Perennial Rye Grass, Red Fescue and Wood's Pasture Mixture. All of these grasses did well the first year until hot, dry weathr and that was the end of most of the plantings. Bermuda seed fail in most instances when planted on thin soil; sodding is by far the safest method. On fertile soil the seed may succeed if seasons are favorable. Blue Grass does nicely on land rick in nitrogen but does not stand on thin upland. Red Top and Orchard Grass do well on valley land, but on thin upland, fail. The other grasses named, Timothy, Rhodes Grass, Tall Meadow Oat Grass, Perennial Rye Grass, Red Fescue and etc., are not worth planting on such land.

Red Clover on clay hill land that had been limed two tons per acre with crushed limestone and a slight application of stable manure did remarkably well. Plantings made elsewhere during September do remarkably well if limed and inoculated. White Clover will grow anywhere in this section but its value as a grazing crop is governed by the soil's fertility.

Black Medic plantings were made March 27, April 10 and September 20, 1920. Over 100 lbs. of seed were used in all the plantings. Various methods were used in testing out this, a very important plant for early and late pasture. Seed mixed with cow manure and dropped from a shovel in small piles on unbroken pasture gave fair results. Seed planted in rows with bur clover on land lightly limed gave the best results. Seed sown on sod or on land broken without lime or manure, failed. All seed planted were inoculated the same as for alfalfa. The one drawback to Black Medic and Bur Clover as a pasture crop, is getting the proper seasons in the fall to germinate the seed and maintain the plant until cool, moist weather. The seed germinate too soon and die from the dry weather that follows, before the fall rains. Where a good sod is secured to help check the loss of moisture better results will be obtained. On the soils here we think a light application of lime will be necessary to grow Black Medic even if other conditions are favorable.

PERMANENT PASTURES.

Considerable work has been done to find the best combination of grasses and clover for pasture on thin hill lands. Lespedeza grows better than any other plant we have found and should have a permanent place in all pastures in the South. Bermuda Grass will grow with Lespedeza nicely and no doubt will head the list of grasses for permanent pasture. By adding White and Bur Clover and we hope later, Black Medic, this list is about complete. Carpet Grass may be grown in place of Bermuda Grass in some instances. The above combination, with probably Red Clover, Alsike Clover, Herds Grass and Kentucky Blue Grass under certain conditions (good soils, wet soils and lime soils) about covers all the grasses we would recommend at this time for permanent pasture. Winter sodding of Bermuda Grass and planting pasture to Bur Clover is discussed in Bulletin 193.

In the fall of 1920 and of 1921, about fifteen acres each year was seeded to Bur Clover. Rows were opened with a shovel plow six feet apart on sod land in September and two bushels per acre of Bur Clover seed were dropped in these furrows and covered with a harrow. This proves a very satisfactory method of planting. The 1920 planting almost seeded solidly the entire land. The seed maturing on the land this summer and the planting this fall are now growing nicely. Our pasture troubles would be ended if Bur Clover could be grown in the pasture each year. The dry falls frequently cause failures unless the soil has been cultivated. Discing the pasture on which there are plenty of Bur Clover seed, say in September, no doubt would do much good.

FORAGE CROPS.

Lespedeza.—This is one of the most valuable hay crops of this section for many farms. There is no better hay grown, and it is probably better adapted to these soils than any other soils of the State. It is one of the easiest crops to grow, no lime or inoculation is necessary. Disc the land, smooth with a harrow and sow not less than one to one and one half bushels per acre the latter part of March. Clip the weeds about once and you have a hay crop for about three years. A crop that will yield from 1 to 2½ tons per acre, according to the fertility of the soil. There are but few better soil improvers than lespedeza.

Sorghum and Cow Peas.—A mixture of about one bushel of sorghum seed and one-half bushel of running cow peas sown broadcast will give probably the heaviest tonnage of good hay that can be found. Planted about May 15th on only soil of fair fertility, four or five tons of hay can be expected.

Vetch.—When vetch is grown as a volunteer winter crop each year, it works in nicely with crops of sorghum and cow peas, corn and other crops that can be planted about the first of June. Such a method will give two crops per year and if the mineral elements, phosphorous and potash are kept up, the soil will improve each year. This is the method

used on the Station farm. We now have over 100 acres in vetch, vetch and rye, and vetch and wheat. Vetch is growing along the sides of the roads, along the fences, in orchards, in vineyards, after all plantings of corn and cotton (except were experiments will not permit), after sweet potatoes, and etc. If this vetch is allowed to seed once in two years it will not be necessary to plant but once. The seed remain in the soil from year to year and only the seed that are close to the surface germinate in the fall when proper seasons are had. After cultivation is ended, vetch takes charge and by May 15th will cut from one to three tons of good hay per acre. At this date some of the seed have matured and will shatter out in harvesting, enough to furnish seed for volunteer vetch for several years. Vetch gives better results with oats and wheat or some grain to support the vine. We have never lost a volunteer vetch crop during a winter. I have seen vetch four inches tall stand 8 degrees F. below zero. Where two tons of limestone were used per acre, vetch in five years increased the yield of corn from 18 to 67 bushels per acre. Each year part of the vetch we removed as hay, the land turned after harvesting the hay and seeded to corn. The more vetch turned under this season, the more corn will be the result the next year. For seeding vetch see two year rotation.

Soy Beans.—For the first time this Station has grown the Biloxi and O-too-tan Soy Beans. Early plantings matured seed this year. It is doubtful whether seed can be matured an average year, as both of the varieties are very late in maturing. We look upon both of these varieties as a forage crop and think if necessary, seed can be purchased each year. The Biloxi bean grew six feet tall on soils that were limed, and easily produced from four to five tons of hay per acre. The beans do not shatter out easily, and one peck of seed is sufficient to plant an acre.

The Cut shown here is the Biloxi Bean taken before maturity. The plants lodged under a heavy wind just before maturity and a second photo was not satisfactory.

O-too-tan Soy Bean.—This plant is shown on the cover page between two corn rows. The seed are much smaller and the stem not near so coarse as other varieties. When planted in 3½ foot rows their growth is upright. We are very much pleased with the plant. The beans do not shatter out readily and can be used for hog grazing when planted between corn rows if not harvested for hay. Cow peas do not grow as

well here as soy beans unless the soil is limed, for that reason we have discarded the growth of cow peas on the farm. The O-too-tan bean is very small and if care was used one gallon of seed will easily plant an acre.

Yellow Mammouth Soy Bean.—Few plants can be found for forage and for grain that will do better on these soils. The beans shatter out easily about harvest time and the stems are coarse. The plant is fine for hay drilled in 26 or 28 inch rows and cultivated, or planted in the row with corn or between the corn rows as described in the O-too-tan bean above. This is the hog crop bean. Beans of some kind should be planted on the row or between the rows of all corn in the State to increase the cash income and keep up soil fertility. If many acres of thin land planted to corn should instead be planted to soy beans alone, much better feed would be had, with a less cost of production.

SILAGE.

Sorghum alone is used for silage on this Station. The variety known as the Japanese Seeded Ribbon Cane is grown entirely by this Station. This is a tall growing, late maturing variety. This sorghum produces about one-third greater tonnage on either thin or fertile soil than corn and is about as valuable ton for ton as corn, the corn silage being slightly the more valuable. It is necessary that the sorghum be full ripe when harvested otherwise sour silage will be the result and this is very undesirable for dairy or beef cattle as only a limited amount can be fed. Sorghum is harder on land than corn because it produces a larger yield. When planted after vetch or some winter legumes the soil's fertility is maintained and large yields are obtained.

The above cut shows sorghum on sandy soil following vetch. This land produced around fifteen tons per acre. Vetch has grown on this land for the past ten years. The land was fertilized with 200 lbs. Acid Phosphate and 100 lbs. Nitrate of Soda per acre.

DAIRYING.

There is a creamery or milk market within forty miles, and in many instances very much nearer farms in this section of the State. There are many thousand acres of idle lands that can be made to produce good grazing and feed crops within a very short time. These lands having been put out of commission growing cotton to purchase hay and feed and dairy products and meat with which to grow more cotton. There are plenty of cows to be had without exerting much effort in finding them. In many instances the cows are on the farms of men who could easily convert a shed (or build one) into a dairy barn and turn the cows in and go to milking. The cream separator companies will sell a separator almost on your own terms. Many banks will lend money on cows as security, to purchase other cows. We do not wish to convey the idea that we think anything that has a hide, horns, and an udder can be made a first class dairy cow, far from it, but we do think a man should start with what he has, or can get, and gradually cull out the poorest ones, by keeping records, and purchase others in exchange. In many instances it would only be necessary for many farmers to purchase two or three cans and a separator to begin dairying.

There are thousands of boll weevil on every cotton farm in the State. Which to put it mildly, makes the growing of cotton more hazardous. There is idle labor on the farm more than half the time that has to be fed. Taxes will have to be paid regardless of whether the land is producing or not. The dairy farmer is about the only man in the country who has made ends meet the past two years. Why not more dairies? If the idle lands of this section are ever redeemed, the dairy cow will play a very important part. The section of country to the north-west of us practiced the one crop system and probably would have been at it yet if the chinch bug had not destroyed their wheat, as the boll weevil is now damaging our cotton. Our Northern brother went into the dairy business and today that section of the country is rated as the wealthiest, per capita, of any other section of the United States.

We have mild winters, cheap lands, cheap labor, longer grazing seasons and can use inexpensive barns and our marketing facilities are just as good as any other section on earth. The dairy at this Station was opened eleven years ago, with cows selected from the country. Some of the cows were not even out of pure bred sires. If there was not a dollar profit in the dairy it would pay in helping to keep up soil fertility and in utilizing the legumes grown on the farm. Soil fertility cannot be profitably maintained without livestock to utilize the legumes and cover crops which should be grown. In Bulletin 165 the net per cow, the kind described above, for four years was $65.00 as an average. During the abnormal times after the late war, the net was more than double that amount. The milking machine installed over a year ago has given good satisfaction. One man attends to about twenty-two cows, milks, cleans the barn and milk vessels and does the feeding. The cost of the milking

machine for electric power is about $15.00 per month. This gives a saving of about $25.00 per month in labor, to say nothing of the sanitary milk obtained.

The dairy is run to encourage the introduction of dairying as a means of increasing farm profits and in maintaining permanent soil fertility. Also to demonstrate the relationship of dairy farming to the improvement of the soil.

Bulletin No. 203 December 1921

Spraying Experiments for the Control of Pecan Scab in Mississippi

By
D. C. NEAL

Mississippi Agricultural Experiment Station
Agricultural College, Mississippi
J. R. Ricks, Director

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D. Maxwell ..... Foreman, Horse and Beef Barns

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*In cooperation, Bureau of Animal Industry, U. S. Department of Agriculture.

Spraying Experiments for the Control of Pecan Scab in Mississippi

By
D. C. Neal

Pecan culture is rapidly becoming one of the most important industries of South Mississippi, especially in the counties bordering along the Gulf coast, and in recent years, extensive plantings have been made in the central and various other sections of the State. As plantings have been increased, many growers are becoming deeply interested in the various diseases and insects which attack the pecan, since these pests are of continually increasing importance as the business enlarges.

Probably the most serious disease of this important nut crop in the State is pecan scab. In view of the numerous inquiries which have been received during the last two years for information concerning this disease, active investigational work was begun on this problem in the summer of 1920 by the Department of Plant Pathology of the Mississippi Experiment Station, with the hope of being able to combat the disease by means of spraying.

Although the information given in this bulletin covers only one season of spraying experiments for the control of the disease, the results are offered to emphasize the importance of spraying, and to impress the pecan grower with the fact that it is a problem which can be partially or perhaps completely controlled, if properly handled. Again, because of the scant information on spraying for the control of the disease in other sections of the country, it was deemed best to submit these results as a preliminary report. The investigation in regard to this problem is being continued.

Before taking up the experimental phases of the work, it appears advisable to outline briefly the symptoms, cause and effects of pecan scab, as well as seasonal variations and their effects, in order that the grower may have these facts fairly well in mind.

PECAN SCAB

(Fusicladium effusum)

Symptoms, Cause, Etc.—Pacan scab is a fungous disease which affects the leaves, twigs and nuts. The disease manifests itself on the leaves in the form of small, velvety, black spots (Fig. 1). These spots, or pustules, contain the spores, or reproductive organs of the fungus, and when mature, they escape from the tissues of the infected host plant and lodge upon fresh surfaces, where in the presence of moisture, they germinate, and continue to spread the disease. As a rule, leaf infections are seldom serious or sufficiently numerous to cause much damage. Twig infection is very similar to leaf infection, but the damage done by the former may sometime cause serious injury, in that the tender shoots are frequently killed back

by the fungus. The greatest injury, of course, is where the disease attacks the nuts (Fig. 2). If infection occurs rather early in the season, very soon after the nuts are formed, the diseased nuts drop before maturity, and infection taking place later in the summer, retards their growth and development, causing many undersized and faulty nuts.

Distributions and Prevalence.—Pecan scab is, no doubt, fairly well distributed over the entire pecan growing sections of the South. Previous investigators (1) have stated that serious damage is confined to a limited number of varieties of pecans grown in the warmer and more humid sections. McMurran and Demaree (1) state that 150 miles inland from the Atlantic and Gulf Coasts, it is of relatively minor importance, even in the case of susceptible varieties. This observation is partly substantiated by observations of the writer in so far as it applies to Mississippi; however, during the last two years, scab has been reported as causing serious damage as far inland as 200 miles from the Gulf Coast. In other words, certain varieties have exhibited about the same degree of susceptibility in widely scattered parts of the State. The disease, in addition to its wide prevalence in the coastal counties, was reported as causing serious loss in Clarke, Hinds, Bolivar, Warren, and Lowndes counties.

Susceptible and Immune Varieties.—There are great differences in the susceptibility of pecans to scab. Among the varieties that are largely pro-

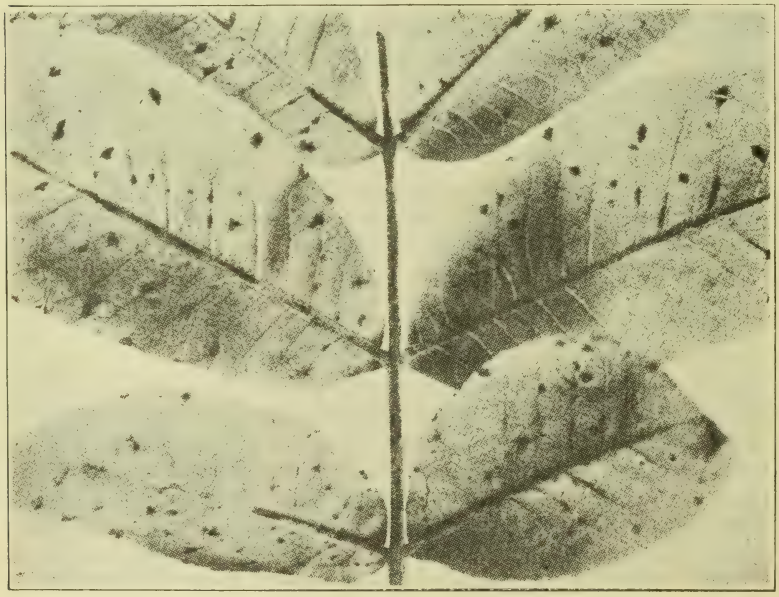

Fig. 1. Pecan leaves infected by the scab fungus. The spots are raised, velvety, black in color, and confined largely to the leaf veins and midribs. (Afer McMurran & Demaree, U. S. Dept. of Agr., Farmers Bulletin 1129, 1920.)

pagated in Mississippi, the most susceptible are the Pabst, Van Deman, and Schley. Delmas is, of course, very susceptible, but this variety is no longer planted to any extent in the State because of its extreme susceptibility to the disease. Success, while apparently free from scab in many parts of the State, has been reported by growers and observed by the writer as scabbing rather severely in points along the Gulf coast. The Stuart, Moneymaker, Russell, Frotcher, Moore, and Alley are varieties which are very resistant and may be listed as practically immune to the disease wherever grown in the State.

SEASONAL VARIATIONS

The severity of pecan scab is, in many instances, determined by the character of the season. The disease is most serious during periods of wet weather. With frequent rainfall, the crops of susceptible varieties may

Fig. 2. A Schley pecan showing the effects of the scab fungus. This nut, although apparently mature, is undersize and faulty.

be completely destroyed. On the other hand, in very dry seasons, the fungus, as a rule, causes only a moderate amount of loss. Thus scab, like many other parasitic fungous diseases, is active and destructive in the presence of abundant moisture, whereas when the season is dry, it does not propagate and injure the host plant so readily. This fact is very important for the pecan grower if he is endeavoring to combat the disease by spraying, a subject which will be discussed later.

EFFECTS OF SCAB IN MISSISSIPPI IN 1920-21

For the past two seasons, the pecan crop, especially in the coastal counties, has been materially damaged by scab. Such susceptible varieties as Pabst, Van Deman and Schley were reduced in yield as much as 50 to 75 per cent in 1920. Reports have also been received from other inland counties, as heretofore mentioned, that the disease was becoming serious and taking a heavy toll of the crop. Although not quite as severe the past season as was the case in former years, the disease was, nevertheless, a limiting factor in production in many parts of Mississippi.

SPRAYING AS A CONTROL FOR SCAB

Previous Work.—McMurran and Demaree (1) state that pecan scab can be successfully combatted by spraying, and recommend a standard Bordeaux mixture composed of 4 pounds of bluestone (copper sulphate), 4 pounds of quicklime and 50 gallons of water as the most satisfactory fungicide. They advise the addition of 1 pound of resin-fishoil soap to each 50 gallons of the preparation, since it increases the adhesiveness of the mixture. These investigators say if the nuts are kept covered with the fungicide from the time they are formed, about the first of May, until the first of September, when growth is almost complete, scab infection will be prevented. Spooner (2) also reports successful results from the use of Bordeaux mixture for scab control in Georgia in 1914. This investigator used a maximum of 4 applications.

SPRAYING FOR SCAB CONTROL IN MISSISSIPPI IN 1921

Location of Experiments.—Realizing the seriousness of the disease in South Mississippi in some of the older established orchards, definite spraying experiments were started in March, 1921 at the orchards of Chas. E. Pabst & Sons, located 4 miles east of Ocean Springs. These trees, consisting of Pabst, Van Deman, Schley, and Success varieties, suffered severely from scab attacks the previous year. Blocks of trees, consisting of 20 Pabst, 20 Van Deman, 6 Schley, and 5 Success, were selected for the work. Suitable checks were also included in each block. The Pabst and Van Deman trees are 18 years of age, whereas, the Schley and Success are about 20 years old. These trees are uniform in size and range from 35 to 50 ft. in height (Fig. 3). It was deemed best to select trees of considerable size for the work, in order to test the practicability of spraying on a commercial scale, or in other words, an effort was made to attack the spraying problem just as it confronts the large pecan grower in orchards of considerable size.

Equipment Used and Schedules Followed.—The spraying equipment used in these experiments consisted of a high power Deming outfit. It is equipped with a 10-horsepower engine and pump of sufficient capacity to discharge 15 to 20 gallons of spray mixture per minute through two leads of hose. To each lead of hose was attached a comet spray gun, one operator spraying the tops of the trees from the tower attached to the spray tank, and the other spraying the lower portion of the tree from the ground. This outfit is capable of maintaining a pressure of between 250 and 300 lbs., and with the exception of a breakdown which occurred in July, all applications were made under the above pressures. The regular 4-4-50 standard Bordeaux mixture was used exclusively, and the first application was made on March 10th, while the trees were dormant. Other blocks of trees of two varieties were not sprayed until in full leaf, in order that comparative tests could be made of the effectiveness of the dormant applications. The first summer application was made on April 21 and 23, at which time the trees were in full leaf, and the sprayings repeated at in-

tervals of approximately 4 weeks. The last application was made on Aug. 2. The interval between applications was lengthened as much as possible, in order to reduce the cost of the operations, as well as to reduce the spraying schedule to a practical basis. This does not imply that 6 or even 7 applications are prohibitive from a standpoint of cost, even in large orchards, but it was thought that if a control of the disease could be effected with a lesser number of applications, for instance, 4 or 5, a great deal of time and some expense could be saved.

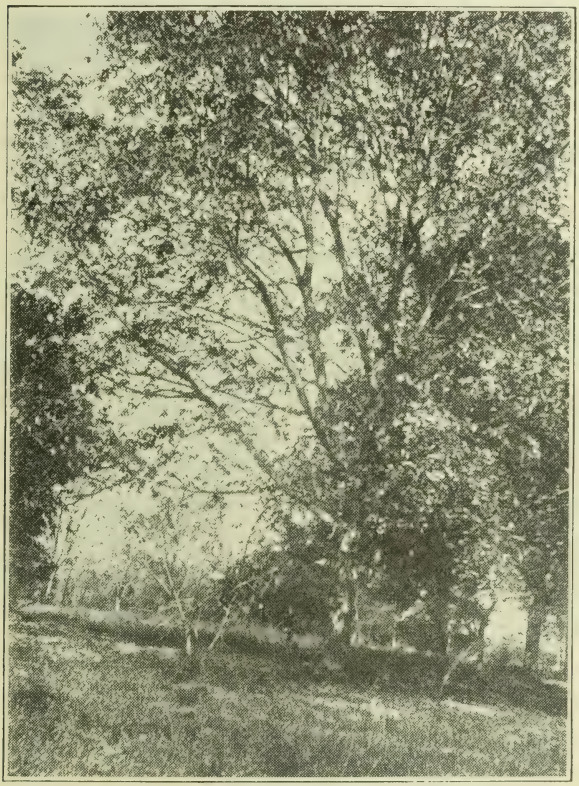

Fig. 3. A block of Pabst pecan trees in the experimental plots at Ocean Springs, Mississippi—Season 1921.

RESULTS OF EXPERIMENTS

In arriving at the effectiveness of spraying the trees with the Bordeaux mixture, as compared with the unsprayed checks, trees of each variety were selected from the sprayed and check blocks for recording the total yield per tree. Time would not permit taking yield records of all the trees in the experiment. The ones selected for recording the yields were approximately the same size and age, and uniform in every way. All the yield records were taken on October 11, 12 and 13th, and are recorded in the table below.

Total yields of sprayed and unsprayed pecan trtes at orchard of Chas. E. Pabst & Sons, Ocean Springs, Mississippi, season 1921.

Variety	Tree No.	Spraying Dates	No. Applications	Yield in lbs. per tree
Van Deman	1	Mch. 10, Apr. 20, May 24, June 29, Aug. 2	5	28
Van Deman	2	Ditto	5	33
Van Deman	3	Ditto	5	22
Van Deman	4	Ditto	5	14
Van Deman	5	Apr. 20, May 24 June 29, Aug. 2	5	24
Van Deman	6	Ditto	5	32
Van Deman	7 (check)	----	Not spraye	5
Van Deman	8 (check)	----	Not sprayed	3
Van Deman	9 (check)	----	Not sprayed	2
Van Deman	10 (check)	----	Not sprayed	3
Pabst	1	Mch. 10, Apr. 20, May 24, June 29, Aug. 2	5	17
Pabst	2	Ditto	5	22
Pabst	3	Ditto	5	25
Pabst	4	Ditto	5	27
Pabst	5	Apr. 20, May 24 June 29, Aug. 2	4	20
Pabst	6	Ditto	4	12
Pabst	7 (check)	----	Not sprayed	1
Pabst	8 (check)	----	Not sprayed	2
Pabst	9 (check)	----	Not sprayed	4
Pabst	10 (check)	----	Not sprayed	½ lb.
Schley	1	Mch. 10, Apr. 20, May 24, June 29, Aug. 2	5	48
Schley	2	Ditto	5	37
Schley	3 (check)	----	Nots prayed	20
Schley	4 (check)	----	Nots prayed	16
Success	1	Mch. 10, Apr. 22, May 26, June 29, July 30.	5	67
Success	2	Ditto	5	152
Success	3 (check)	----	Not sprayed	22
Success	4 (check)	----	Not sprayed	47

A glance at the table shows readily the effectiveness of the spraying with the Bordeaux mixture. In the case of each of the four varieties, the sprayed trees reveal a much higher yield than the unsprayed. The total yield per tree is also the only accurate criterion of the loss resulting from diseased nuts dropping prior to maturity. The weights in the case of the

checks also reveal the undersize and faulty nuts, as illustrated in (Fig. 4). Figure 5 shows the size of a cluster of Pabst pecans taken from a tree which received 4 applications. In the case of this variety, control of the disease was difficult, but even with intervals between spraying of at least 4 weeks, the disease was held in check for a sufficient length of time to allow the sprayed trees to mature their crops. On the other hand, the yields of the unsprayed check trees of the Pabst variety were practically a complete failure (Fig. 4).

The same results of the effectiveness of the Bordeaux mixture is also observed in the case of the Van Deman (Figs. 6 and 7), the Schley (Figs. 8 and 9) and the Success varieties. In the case of the Schley, very little scab was noted on the nuts in either the sprayed or check trees, until about the middle of July. At about this time, plenty of rain occurred and the disease began to make its appearance in the Schley, as well as Success check trees. This accounts for the large size of the Schley nuts in Fig. 9 Here the fungus did not get well distributed over the trees until late in

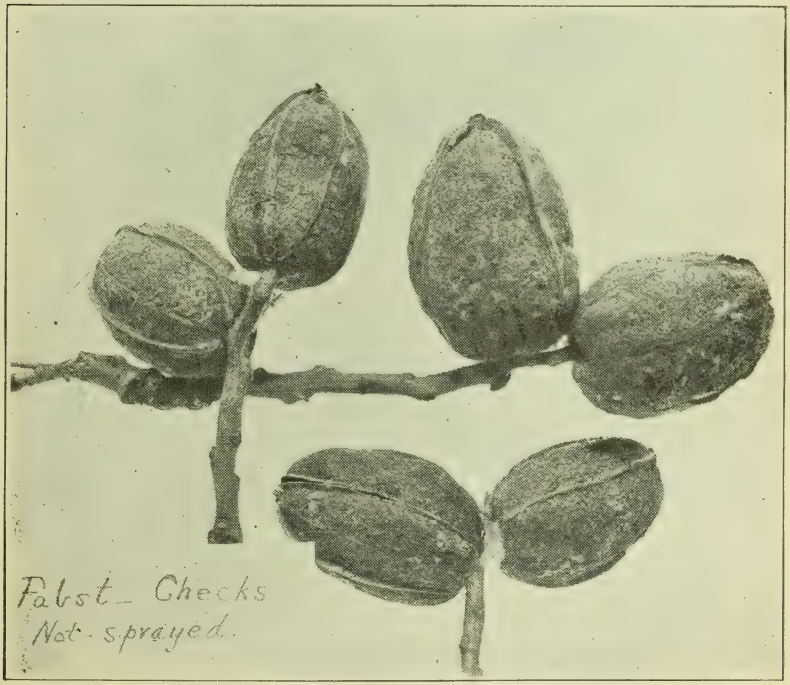

Fig. 4. Pabst--Checks--Not sprayed. Note scabby effect, undersize and faulty clusters. (Photographed by J. M. Beal, Miss. A. & M. College.)

the summer, thus allowing the nuts to attain considerable size before attacking them. The checks (unsprayed) Schley's as illustrated by the clusters in figure 9 are large, but it will be noticed that the scab spots are numerous and these nuts are not well filled, as is the case of the clusters from the sprayed trees as illustrated in figure 8.

It is also noted that the trees which received a dormant application of Bordeaux mixture on March 10th show but little differences in the yields from those which only received the summer applications. Further investigation appears to be needed on the matter of the advantages of dormant applications of Bordeaux and other fungicides.

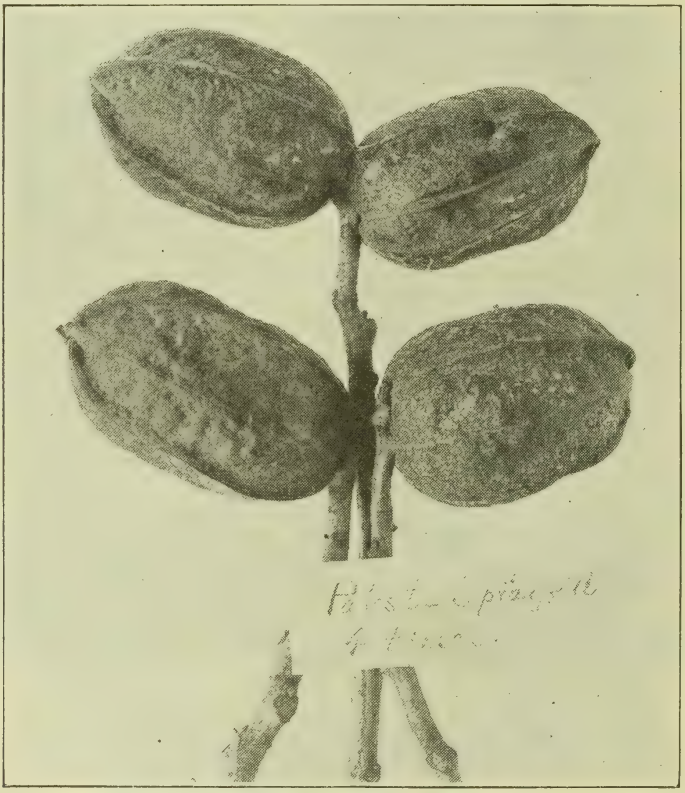

Fig. 5. Pabst pecans sprayed 4 times. Some late scab infection is present, but nuts are sound, large and fully mature. (Photographed by J. M. Beal, Miss. A. & M. College.)

CONCLUSIONS AND RECOMMENDATIONS

The results presented in this bulletin clearly indicate and corroborate the work of other investigators that pecan scab can be successfully controlled by spraying with Bordeaux mixture. Spraying to control pecan scab

and various other fungous diseases of many hosts is a preventive measure. It does not act as a cure after the disease is once established in the host. Consequently, the importance of keeping the nuts covered with the fungicide from the time they are formed and mature, to prevent the disease from developing, is very essential. A definite spraying schedule will depend upon the amount of rainfall in a given locality. If the season is very wet, the interval between applications should be shortened in order to keep the nut clusters well covered with the fungicide, whereas, if the season is moderately dry, the interval between applications may be lengthened as much as 3 or 4 weeks with every expectation of success. With an average season for Mississippi conditions, from 4 to 5 applications appear to be necessary for good control of the disease. The first spraying should begin about the time the young nuts are formed, and they should be kept covered with the poison until about Aug. 1 or 15th.

In the case of large trees which were included in these experiments, that is, those ranging in height from 40 to 50 ft. and from 18 to 20 years

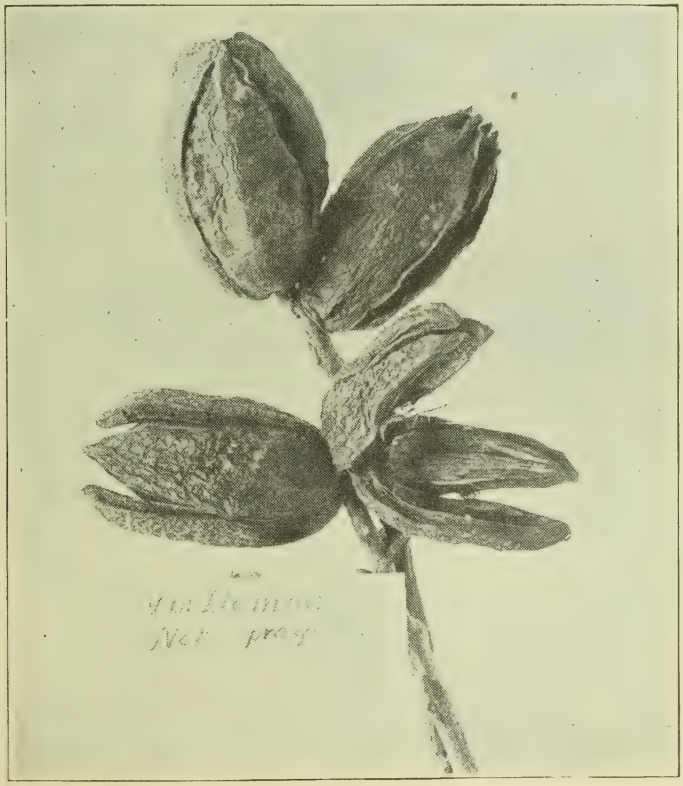

Fig. 6. Van Deman pecans not sprayed. (Photographed by J. M. Beal, Miss. A. & M. College.)

of age, only power spraying outfits should be used. These should be equipped with 8 to 10-horsepower engines and pumps of sufficient capacity to discharge from 15 to 20 gallons of the liquid per minute through two leads of hose. Spray guns are also necessary, as well as specially constructed hose and connections, and pressures of at least 250 to 350 pounds must be maintained with these outfits. For smaller orchards and trees of medium height, the smaller power machines, from 3 to 4 horsepower, with extension rods and tower, may be used to advantage.

It seems hardly necessary to emphasize the importance of thorough spraying to control a disease like pecan scab. Nevertheless, any sort of spraying or merely shooting the liquid into the tree will not suffice. Every effort should be made to cover all portions of the tree and cover all the nut clusters. One man working from the tower attached to the spray tank can cover the top of the tree with a spray gun, and another working from the ground can cover the lower branches. Where the trees are planted in

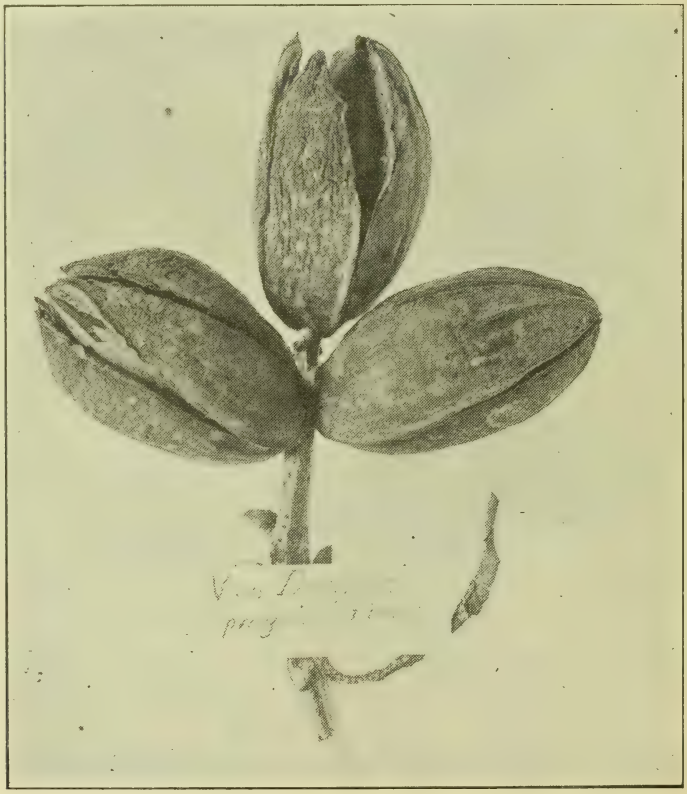

Fig. 7. Van Deman pecans sprayed 5 times. (Photographed by J. M. Beal, Miss. A. & M. College.)

definite rows, which is usually the case in most orchards, it is usually best to drive the sprayer on one side of the tree and spray thoroughly and then drive down the same row and repeat the spraying on the opposite side of the tree. This insures a thorough job.

The problem of spraying pecan trees for scab is being continued by the Department of Plant Pathology of the Mississippi Experiment Station. It is hoped that further progress on the effectiveness of other fungicides, dormant spraying, etc., may be available after further investigations.

Spraying should not be looked upon as the only control measure for pecan scab. For the person who is contemplating planting a pecan orchard in South Mississippi or points within a 200-mile radius of the Gulf coast, the scab-resistant and immune varieties mentioned on page 5 are recommended. In the case of established orchards of susceptible sorts, top-working to scab-resistant varieties is sometimes carried out. However,

Fig. 8. Schley pecans, sprayed 5 times. (Photographed by J. M. Beal, Miss. A. & M. College.)

this is in many instances objectionable from the standpoint of time that is lost before the tree is able to put on sufficient growth to produce profitable crops. In such instances, spraying to control the disease is preferable.

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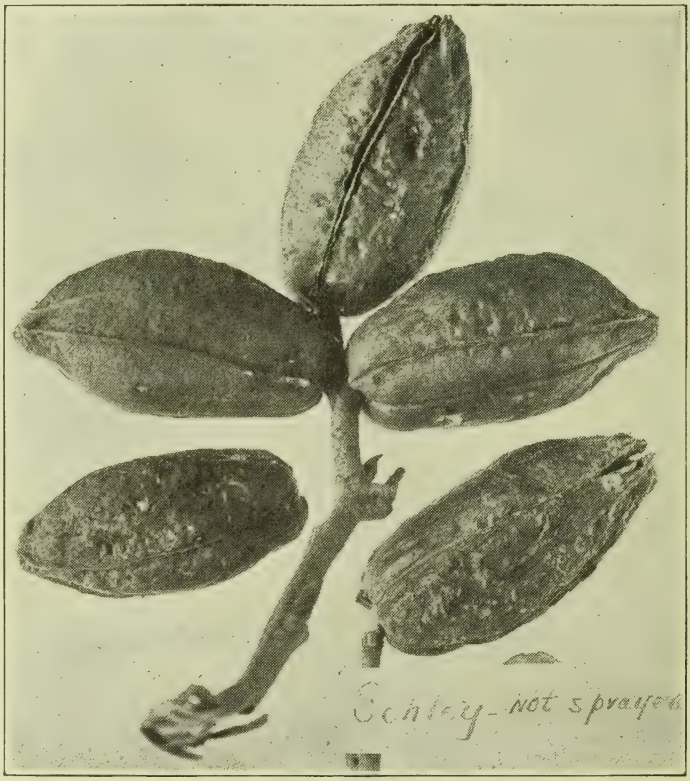


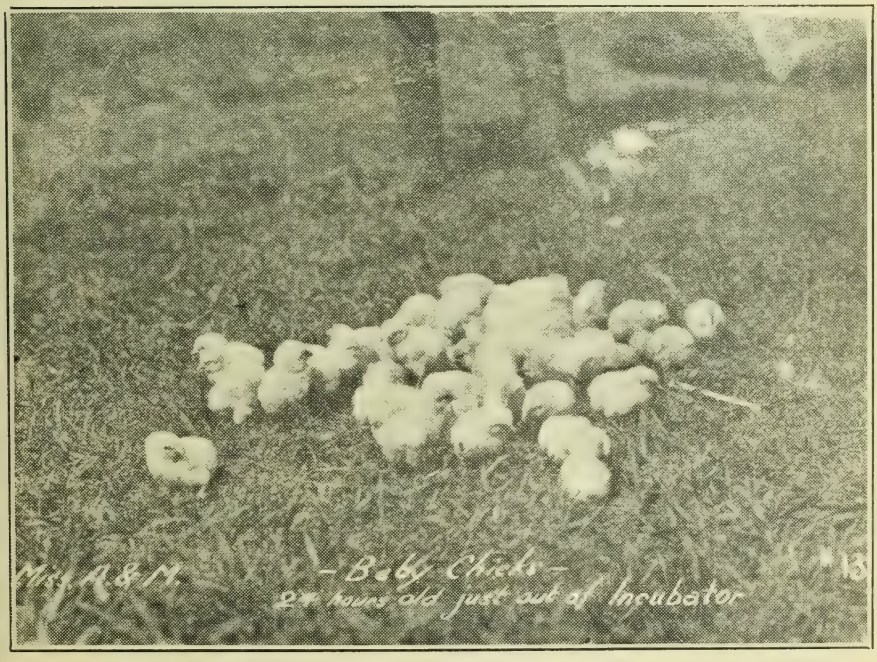
Fig. 9. Schley pecans (checks) not sprayed. (Photographed by J. M. Beal, Miss. A. & M. College.)

BULLETIN NO. 204 DECEMBER 1921

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

1920 and 1921 Experiments With Poultry.

By
E. P. CLAYTON
and
J. P. CLAYTON



BABY CHICKS

Agricultural College, Mississippi
J. R. Ricks, Director.

The Torgerson Press, Jaxon

Some Outstanding Features in this Bulletin.

1. Leghorns are more profitable egg producers than the general purpose breeds.

2. Hens will not lay well without some form of protein. Milk is the best form of protein to feed to laying hens and growing stock.

3. It is more profitable to feed the surplus milk to chickens than to pigs.

1920 and 1921 Experiments with Poultry

By

E. P. CLAYTON

and

J. P. CLAYTON

Many people are unaware of the profits and losses made on a single fowl or a group of fowls due to not keeping accurate records. This department has endeavored to put clearly before the people just what to expect from a flock of fowls and has for the past two years conducted an experiment with four breeds to determine which would produce the most profits under ordinary conditions from egg production alone.

In this experiment we have not credited the fowls with any breeding stock or eggs sold. The only credits they have received have been the market value of the eggs laid. The average market price for 1920 was around 41 cents and for 1921 around 38 cents, showing a difference of about 3 cents for the year. The basis upon which we worked was the prevailing market prices each month.

The first year of this experiment was conducted under abnormal prices, feed being higher than for many years before. Eggs were also higher than ever before so the results obtained will hold true even under normal prices. The second year found both feed and eggs declining toward normal, feed dropping more in comparison than did eggs. A close study of tables No 1 and 2 will show several interesting things.

1920—TABLE NO. 1—SHOWING PRODUCTION, COST AND PROFTS.

Breeds	No. of hens	Total feed consumed	Cost of feed	Eggs laid doz.	Value of eggs	Cost eggs doz.	Eggs per hen	Feed per hen	Cost per hen	Profit per hen
Rhode I. Reds	140	10,038 lb	$414.47	1396	$ 582.00	30c	112.5	72 lb	$2.96	$1.20
White Leghorns	47	3,231 lb	$137.21	614	$ 243.50	22c	157	69 lb	$2.92	$2.26
Brown Leghorns	66	3,988 lb	$161.81	694	$ 283.35	23c	126	60 lb	$2.45	$1.84
Barred P. Rock	39	2,952 lb	$121.26	347	$ 132.24	35c	107	76 lb	$3.10	$0.29
Totals	292	20,209 lb	$834.75	3051	$1,241.09	27c	126	69 lb	$2.85	$1.40

1921—TABLE NO. 2—SHOWING PRODUCTION, COST AND PROFITS—1921

Breeds	Number hens	Total feed consumed	Total milk consumed	Cost of milk and feed	Eggs laid dozens	Value of eggs	Cost per dozen eggs	Eggs per hen	Feed per hen	Cost per hen	Profit per hen
Rhode I. Red Pullets	87	6074lb	5848lb	$189.22	1065	$ 396.13	17c	149	69lb	$2.12	$2.33
Rhode I. Red Hens	95	6507lb	5649lb	$200.82	891	$ 343.82	23c	123	71lb	$2.07	$1.55
White Leghorn Hens	20	1281lb	1297lb	$ 38.57	287	$ 98.33	13c	163	63lb	$1.82	$2.80
Brown Leghorn Hens	40	2260lb	2481lb	$ 69.34	515	$ 184.72	11c	156	57lb	$1.68	$3.15
Brown Leghorn Pullets	23	1219lb	975lb	$ 37.18	263	$ 106.32	14c	142	55lb	$1.59	$2.73
Barred Plymouth Rock Hens	18	1414lb	1384lb	$ 47.24	160	$ 51.72	30c	104	73lb	$2.46	$0.35
Totals	303	18755lb	17632lb	$582.37	3181	$1,181.04	18c	140	65lb	$1.95	$2.15

First compare the egg breeds. The White Leghorns ate an average of 69lb of feed the first year, produced 157 eggs each with a profit per hen of $2.26. The Brown Leghorns ate an average of 60lb per hen of feed, produced 126 eggs per hen and made a profit of $1.84 each.

The White Leghorns ate 63lb of feed the second year, laid 163 eggs each with a profit of $2.80 per hen. The Brown Leghorns ate 57lb of feed, laid 156 eggs with a net profit of $3.15 each.

During the test the White Leghorn hens made a profit each month, reaching the maximum in January 1921 with a profit of 49 cents each. The Brown Leghorns also reached their maximum in January 1921 with 48.7 cents each but were losers in September and October 1920, losing 4 cents in September and 8 cents in October.

The White Leghorns made a profit of $5.06 for the two years. During the two years each hen produced 25 dozen eggs and ate 132lb of feed. She produced over ten times her weight in eggs. The Brown Leghorns made $4.99 profit in the two years, laid 23½ dozen eggs and ate 117lb of feed. She also produced about ten times her weight in eggs. It would be hard to choose between the Browns and Whites here as efficient egg producers. There is a dfference of only 7 cents in favor of the Whites during the past two years. The Whites led during 1920 and the Browns during 1921.

In comparing the Reds and the Rocks, the Reds are far in the lead. The Rocks produced almost as many eggs as did the Reds but they were produced during the spring and summer when prices were low and very few produced during the fall and winter when prices were high.

Table No. 1 shows us that the Reds laid 112.5 eggs, ate 72lb of feed and made a profit of $1.20 each during 1920. The Rocks ate 76lb of feed, laid 107 eggs each with a profit of $0.29 each. The Reds made a profit of $1.55, ate 71lb of feed and laid 123 eggs each during 1921. The Rocks ate 73lb of feed,

laid 104 eggs each and made a profit of $0.35 each in 1921. The Reds made a profit every month except September 1920 and lost less than 1 cent each that month. Their maximum was reached in January 1921 with a profit of 24 cents each. The Barred Rocks lost in eight months of the test. These months were August, September, October, November, and December 1920 and in September and October 1921. Their highest profit was reached in March 1921 with 21 cents each.

The Reds made $2.75 profit during the two years. Each hen produced 19½ dozen eggs and ate 143lb of feed. Each hen produced five times her weight in eggs. The Rocks ate 149lb of feed and made $0.64 profit while on test. They produced 17½ dozen eggs or four times their weight in eggs.

The Reds proved to be the best winter layers of the two general purpose breeds on test. The Barred Plymouth Rocks produced almost as many eggs but they were produced in late winter, spring and summer. If broilers and roasters had been considered, no doubt the Rocks would have shown up better.

SKIM MILK FOR EGG PRODUCTION.

To determine the value of skim milk or buttermilk for laying hens, we used four pens of White Leghorn pullets of equal numbers (16 to the pen), and equal in production as well as could be judged. Each pen had a mixed grain twice per day and dry mash before them all the time.

Pen No. 13 was fed a mash composed of equal parts by weight of corn meal, wheat bran, wheat shorts, and cotton seed meal. Cotton seed meal being the protein for this pen.

Pen No. 14 had the same as 13 except beef scrap was substituted for cotton seed meal.

Pen No. 15 had the same as 13 and 14 except milk (all they could drink) was substituted for the protein.

Pen No. 16 was the same as 13, 14, and 15 except no protein was used. This was the check pen.

The results of this test are shown in table No. 3.

TABLE NO. 3—SHOWS THE COMPARISON BETWEEN COTTONSEED MEAL, BEEF SCRAPS AND SKIMMED MILK AS A PROTEIN FEED FOR CHICKENS. NOTE PEN NO. 16 WHICH DID NOT HAVE ANY PROTEIN IN THEIR FEED.

	No of hen	Total feed consumed	Total milk consumed	Total cost of feed	Eggs laid doz.	Value of eggs	Cost per doz. eggs	Eggs per hen	Feed Cost per hen	Profit per hen
Pen No. 13	15	614lb	000lb	$14.59	110	$31.76	13.2c	88	$0.97	$1.14
Pen No. 14	16	649lb	000lb	$15.47	133	$38.97	11.6c	99	$0.96	$1.47
Pen No. 15	14	509lb	1524lb	$16.43	145	$42.54	11.3c	123	$1.14	$1.86
Pen No. 16	16	510lb	000lb	$12.05	75	$21.74	29.0c	56	$0.75	$0.60

NOTE—This experiment has been running for only eight months. It will be continued for several years and results given out from time to time.

Pen No. 13 consumed 88lb of crude protein during the test, produced 110 dozen eggs worth $31.76 and made a profit of $1.14 each.

Pen No. 14 consumed 101lb of crude protein, produced 133 dozen eggs worth $38.97 and made a profit of $1.47 each.

Pen No. 15 consumed 103lb of crude protein, produced 145 dozen eggs worth $42.54 and made a profit of $1.86 each.

Pen No. 16 got no protein except what was in the regular ration. They ate only 57lb of crude protein, produced 75 dozen eggs worth $21.74 and made a profit of 60 cents each.

From this test and others it is evident that plenty of protein is essential for maximum egg production and that milk is the best form of protein.

SKIM MILK FOR GROWING CHICKS.

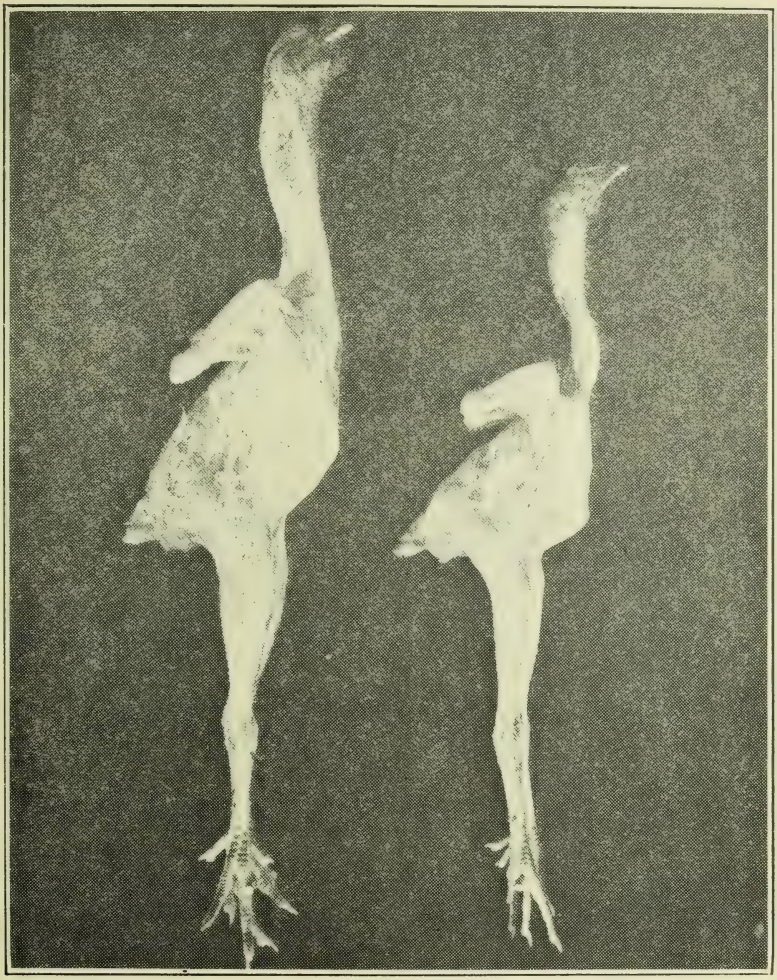
On May 10 we began a test with two lots of baby chicks, twenty-five to each lot. The first lot (the results of which are given in table No. 4) was fed a regular chick ration and in addition was given all the milk they would drink. The second lot (the results of which are given in table No. 5) was fed a regular chick ration, the same as was fed to lot No. 1 except that they received no milk.

When the chicks were one month old there was no difference in their weight, but at two months of age it was found that lot No. 1 had gained 1.4lb while Lot No. 2 had gained only .9lb, Lot No. 1 gaining ½lb more than Lot No. 2. There was a difference of 11 cents per bird profit, due to the skim milk.

At three months of age we find that there is nearly a pound difference between the two chicks. Lot No. 1 weighed 2.3lb while Lot No. 2 only weighed 1.5lb. At five months we find that the skim milk bunch weighed 4.55lb each, have consumed 41 cents worth of feed each and made a profit of 65 cents per chick. The water bunch weighed 2.5lb each, consumed 34 cents worth of feed each and made a profit of 26 cents per chick. There is a difference of 39 cents in favor of the skim milk. Considering that this difference is due to the skim milk, it would place a value of 11 cents per gallon on it when fed to young chicks.

A very interesting part of this experiment was the result obtained after the five months was up by taking half of the birds that had been getting milk and giving them water. We also took half of the birds that had been getting water and gave them milk. The lot that was changed from water to milk, we call No. 3 and the lot that was changed from milk to water we will call No. 4. This was continued for one month with the following results: Lot No. 1 gained one pound each per bird, Lot No. 2 gained ¼ pound each per bird, Lot No. 3 gained one pound per bird, while Lot No. 4 gained less than ¼ pound per bird.

This is conclusive evidence that skim milk is one of the best and cheapest feeds that we can feed to young chicks. You will notice how rapidly the birds began to gain as soon as changed from water to milk and how readily they stopped gaining when changed from skim milk to water.



MILK FED VERSUS WATER FED.

Figure No. 1 gives a clear cut comparison of the relative sizes of the two birds. The largest, a milk fed cockerel, weighed 6½ pounds when 5 months old; the smaller, a water fed cockerel, weighed 2½ pounds when 5 months old. The pullets in Lot No. 1 began laying in December while the pullets in Lot No. 2 will not lay before February or March.

TABLE NO. 4—SHOWING RESULTS OF FEEDING MILK TO YOUNG CHICKS AND GROWING STOCK.

"This lot received milk."

Age	No. of Chicks	Weight per Chick	Gain per Chick	Grain per Chick	Mash per Chick	Milk per Chick	Feed cost per Chick	Profit per Chick
1 day	25	.1lb	.1lb	.0lb	.0lb	.0lb	.0c	.0c
1 month	25	.75lb	.65lb	.4lb	.4lb	1.5lb	2c	14c
2 months	25	1.50lb	.75lb	1.0lb	1.0lb	4.0lb	6c	12c
3 months	25	2.30lb	.80lb	1.4lb	1.4lb	6.5lb	9c	11c
4 months	16	3.60lb	1.30lb	2.0lb	2.0lb	8.0lb	12c	15c
5 months	16	4.55lb	.95lb	2.0lb	2.0lb	8.0lb	12c	13c
TOTALS	16	4.55lb	4.45lb	6.8lb	6.8lb	28.0lb	41c	65c

TABLE NO. 5—SHOWING RESULTS OF FEEDING MILK TO YOUNG CHICKS AND GROWING STOCK.

"This lot received water."

Age	No. of Chicks	Weight per Chick	Gain per Chick	Grain per Chick	Mash per Chick	Feed cost per Chick		Profit per Chick
1 day	25	.1lb	.0lb	.0lb	.0lb	0c		0c
1 month	25	.75lb	.65lb	.4lb	.4lb	2c		14c
2 months	25	1.0lb	.25lb	1.0lb	1.0lb	5c		1c
3 months	25	1.5lb	.50lb	1.4lb	1.4lb	7c		6c
4 months	16	2.1lb	.60lb	2.0lb	2.0lb	10c		5c
5 months	16	2.5lb	.40lb	2.0lb	2.0lb	10c		0c
TOTALS	16	2.5lb	2.40lb	6.8lb	6.8lb	34c		26c

SKIM MILK FOR PIGS AND COMPARATIVE GAINS WITH CHICKENS.

On July 26 we put two pigs on the milk feed and two on the water feed. The pigs receiving milk weighed 32lb at the beginning of the test and 121lb at the end of 45 days. Those receiving water weighed 37lb at the beginning of the test and 64lb at the end of the 45 days. This gives the milk pen or Lot No. 1, 89lb gain in 45 days with a profit of $4.15, and the water pen or Lot No. 2, a gain of 27lb in 45 days with a profit of 43 cents.

To make sure that this gain was due directly to skim milk, we reversed the experiment on September 13 and put Lot No. 1 on water and Lot No. 2 on milk ration. One month later Lot No. 1, now on water, weighed 140lb or a gain of 19lb with a loss of 69 cents. Lot No. 2, now on milk, weighed 147lb or a gain of 83lb with a profit of $3.72.

These pigs received the same feed with the exception of the skim milk. They were fed a grain ration of corn chops and mash composed of equal parts of corn meal, wheat bran, and wheat shorts. For the first 45 days each lot consumed 50lb of grain and 50lb of mash. The skim milk lot consumed 75 gallons of milk.

For a month after the experiment was reversed, each lot consumed 60lb of grain and 60lb of mash, with the skim milk lot getting 80 gallons of skim milk.

Considerng that the difference in gains was due to the skim milk it would place a value of 5 cents per gallon on it when fed to pigs. Comparing the gains made by the pigs on skim milk and the gains made by the chickens on skim milk, we find there is a difference of 6 cents per gallon in favor of the chickens. That is the chickens paid 11 cents per gallon for all the skim milk they drank, while the pigs paid only 5 cents for the milk they drank. Chickens were worth 25 cents per pound and pigs were worth 8 cents per pound.

Bulletin No. 205 December, 1921

Cotton Experiments

BY
H. B. BROWN AND J. F. O'KELLY

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
J. R. RICKS, DIRECTOR

STATION STAFF.

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H. B. Brown, Ph. D..... Plant Breeder, Vice-Director, Chief in Agronomy
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C. T. Ames, B. Sc.....Assistant Director, Holly Springs Branch Station
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C. B. Anders, B. Sc.....Assistant Director, Raymond Branch Station
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F. C. Cottrell..... Agricultural Engineering
J. C. C. Price, B. Sc.....Horticulturist
D. C. Neal, B. Sc. M. A.....Plant Pathologist
..... Dairyman
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R. N. Lobdell, M. Sc.....Entomologist
W. E. Ayres, B. Sc., M. Sc. .....Plant Breeder, Delta Branch Station
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F. B. Richardson, B. Sc.....Horticulturist, South Miss. Branch Station
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F. M. Herzer, B. Sc.....Associate Dairyman
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D. Maxwell.....Foreman, Horse and Beef Farms

*In cooperation Bureau of Animal Industry, U. S. Department of Agriculture.

COTTON EXPERIMENTS, 1921

By H. B. Brown and J. F. O'Kelly

This Bulletin is written to report results from certain experiments carried on in 1921. It is thought that these results will be of interest and direct practical value to cotton growers in the east central part of the State. To know what variety of cotton is best suited to his conditions as a matter of importance to the grower. As will be seen by referring to Table 1, in this bulletin, the money value of the products of certain varieties is very much greater than that of others, the value of the leader in the test was more than double that of the lowest variety. Many so-called varieties are simply old varieties under different names, also some of the most highly advertised varieties have the least merit. Growers should be protected against such. A well conducted variety test by a disinterested party is a good means of protection.

If in the variety test pure seed of the variety is used, plats arranged so as to do away with the differences due to inequalities of soil, sufficient replication used, and environmental conditions noted carefully, the results obtained are dependable.

The samples sent to the classers were numbered and handled without the classers knowing the names of the varieties from which they came. This insured impartial judgment.

Seed of the best of the new strains developed by the Experiment Station will be distributed as soon as they are available in quantity.

The Weather.—Over a large part of the State, the weather during April and a part of May was abnormally cold and wet, making it difficult for cotton growers to prepare a good seed bed or get seed to germinate after planting. Many fields were planted over two or three times, thus making the crop late. Many fields, also, went through the season with poor stands. Unusually hot, dry weather during June, July, and August retarded the vegetative growth and fruiting of cotton plants, but it was favorable to the crop in the main for it served as an effective check to the boll weevils. Continued dry, warm weather in the fall was very favorable for picking, making it possible to harvest a higher percentage of the crop than usual. This increased the total yield for the year considerably, and also the percentage of high grade cotton.

Boll Weevils.—In many parts of the State, boll weevils appeared earlier in the season than ever before and in larger numbers than usual for the initial infestation. The warm winter preceding was doubtless largely responsible for such a large number of weevils coming out of hibernation. In the southern part of the State the weather did not get cold enough to kill the stubs of the old cotton plants. Many weevils wintered in the cotton fields. In the northern part of the State, they appeared earlier than they ever have before and in many places did more damage than ever before. Damage was also moderately heavy in the Delta counties. Considering the state as a whole, damage was worse than it has been since 1916. Had not the weather been favorable for the

repression of weevils,—hot and dry during July and August,—the losses would have been extremely heavy.

Classing and Prices.—The cotton listed in this bulletin were stapled, classed in respect to strength and character of staple, and priced by the Staple Cotton Cooperative Association,* which has headquarters at Greenwood, Mississippi. Prices are based on middling grade white cotton, December 7 market. These prices may seem high, and in fact are higher than were obtained in most of the interior cotton markets of the State, but they are no better than were obtained by the Staple Cotton Cooperative Association and other cooperative marketing associations that graded and pooled their cotton properly, and did sufficient business to be able to market it to best advantage.

Variety Test.—The cotton in the main variety test was planted April 25 on fairly fertile Houston Clay valley land. Enough work was done on the land to prepare an excellent seed bed, and more than a bushel of seed per acre was planted. As a result an excellent stand was secured. The first bloom appeared June 22, while boll weevils were found June 13, nine days in advance of the first blossom. They increased in numbers rapidly and became more numerous than ever observed before in an initial infestation in this locality. Six applications of the calcium arsenate spray were applied as explained in another part of this bulletin. This poisoning aided by the dry weather that prevailed, served to hold the weevils in check fairly well and a good crop was made.

The yields per acre, lint percentage, length of lint, and other characteristics of the varieties and strains grown are shown in Table I. It will be noticed that Miss. Sta. Trice led in yield the first picking, indicating comparative earliness. Piedmont Cleveland led in yield of seed cotton and is an excellent cotton for the hill section of Mississippi. Half and Half has a very high lint percentage and produced more lint per acre than any other variety but the staple was of such a nature that the classers considered it unsalable. Delta-Type Webber, Express 350—718, and Delfos 6102 are leaders in money value. The good premium paid for staple cotton this year made these varieties especially valuable.

Second Variety Test.—This test contains several new strains developed by the Experiment Station, and varieties sent to us for testing for which there was not sufficient room in the First Variety Test. Most reliable results are secured by running tests in which there are not more than twenty-five varieties. It is better to run two small tests rather than one large one. The Second Variety Test was on a cut of land adjoining the one used for the First Test, but it was not as fertile, and the cotton was injured more by dry weather. The cotton in the two tests was planted at the same time, and handled in the same way. Miss. Sta. Trice, Cleveland 37w—54, Acala No. 5, Express 433, and Delfos 6102 were used in both tests and will serve as checks to connect the two. Here as in the other test, the varieties with long lint rank highest. The main results from the test are shown in Table II.

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*We are greatly indebted to Mr. W. M. Garrard and his associates in the cotton grading office for this service.

TABLE I. COTTON VARIETY TEST—COLLEGE—1921.

VARIETY	Yield per Acre 1st Picking.	Yield per Acre 2nd Picking	Total Yield per Acre.	Lint Cotton per Acre.	% Lint	Length of Lint in Inches.	Value of Lint per Pound in Cents	Pounds of Seed per Acre	Value of Seed at $25.00 per Ton	Value of Lint per Acre	Total Money Value	Rank in Money Value	Strength of Staple	Character of Staple
Simpkins	1125.7	290.3	1416.	535.2	37.8	⅞	17	880.8	11.01	90.98	101.99	21	Fair	Fair
Bank Account	948.	221.6	1169.5	397.6	34.0	15-16	18	771.9	9.72	71.56	81.28	23	Good	Good
Miss. Sta. Trice	948.	286.	1507.3	470.3	31.2	1 1-16-1 ⅛	25	1037.	12.96	117.57	130.53	11	Good	Good
Wannamaker-Cleveland	1196.8	280.8	1477.7	554.1	37.5	⅞	17½	923.6	11.54	96.96	108.50	18	Fair	Good
Cleveland, 37W-54	1273.9	274.9	1548.8	552.9	35.7	15-16	17½	995.9	12.45	96.75	109.20	17	Fair	Fair
Piedmont Cleveland	1285.7	328.2	1614.	571.3	35.4	1	18	1032.7	12.88	102.83	115.71	16	Good	Good
Cook, 1010	1102.5	278.5	1380.5	555.0	40.2	⅞	17½	725.5	9.06	97.12	106.18	20	Good	Good
Half & Half	1113.9	225.1	1339.	589.1	44.0	⅝	00	749.9	9.37	.....	.....	.....	Fair	Fair
Cleveland Big Boll	1084.3	337.7	1422.	500.5	35.2	1	18	921.5	11.52	90.09	101.61	22	Good	Good
Miller	924.3	529.7	1454.	497.3	34.2	1 1-16	22½	956.7	11.96	111.88	123.84	13	Fair	Good
Triumph	959.8	367.3	1327.2	495.0	37.2	1 1-16	22¾	832.2	10.40	112.61	123.01	14	Good	Fair
Lone Star (Ferguson)	1007.2	399.3	1406.5	516.2	36.7	1 1-16-1 ⅛	24½	890.3	11.13	126.46	137.59	5	Good	Fair
Lone Star 11-65	1036.9	233.4	1270.3	438.2	34.5	1 3-16	29	832.1	10.40	127.07	137.47	6	Good	Fair
Acala No. 5	953.9	349.6	1303.5	474.5	36.4	1 ⅛-1 3-16	27	829.	10.37	128.11	138.48	4	Fair	Fair
D. & P. L. No. 1	936.1	349.6	1285.7	425.6	33.1	1⅛	27	860.1	10.75	114.91	125.66	12	Good	Good
Express 432	1108.3	263.	1371.2	440.1	32.1	1 ⅛-1 3-16	28	931.1	11.64	123.22	134.86	9	Good	Good
Express 432-782	1102.0	268.9	1370.9	431.8	31.5	1 3-16-1 ¼	28	939.1	11.74	120.90	132.64	10	Fair	Fair
Express 433	1054.6	242.9	1297.5	356.9	27.5	1 3-16	27	940.6	11.76	96.36	108.12	19	Fair	Fair
Express 350-718	1096-1	231.	1327.1	383.5	28.9	1¼	34	943.6	11.80	130.39	142.19	2	Good	Good
Delfos 6102	1113.9	201.4	1315.3	426.1	32.4	1 3-16-1 ¼	30	889.2	11.12	127.83	138.95	3	Good	Fair
Delfos 631	1131.7	266.6	1398.2	443.2	31.7	1 3-16-1 ¼	28	955.	11.94	124.09	136.03	7	Fair	Fair
Sunpress	1096.1	231.4	1327.5	334.5	25.2	1⅜	37	993.	11.17	123.76	134.93	8	Good	Fair
Webber 49-4	841.3	203.8	1045.1	310.4	19.7	1 5-16	35	734.7	9.18	108.64	117.82	15	Good	Fair
Delta Type Webber	1137.6	227.5	1365.1	423.2	31.0	1⅜	37	941.9	11.77	156.58	168.35	1	Good	Fair

TABLE II. SECOND CO[illegible]ON VARIETY TEST—COLLEGE—1921,

VARIETY	Yield per Acre, 1st Picking	Yield per Acre 2nd Picking	Total Yield per Acre	Yield for Perfect Stand	Lint per Cent	Lint per Acre	Length of Lint	Value of Lint per lb. in Cents	Value of Lint per Acre	Value of Seed at $25.00 a Tn	Total Money Value	Rank in Money Value
Trice 78	668.3	106.6	774.9	826	33.4	275	1⅛	27	74.25	6.88	80.13	9
Trice 53	718.1	120.8	838.9	847	31.6	267	1 1-16 1⅛	24½	65.42	7.25	72.69	14
Miss. Sta. Trice	774.9	142.2	917.1	953	31.4	299	1⅛	27	80.73	8.17	88.90	5
Cleveland 37W-54	746.5	184.8	931.3	976	36.2	353	1	18	63.54	7.78	71.32	16
Allen's Big Boll	682.5	234.6	917.1	944	37.1	350	⅞	17	59.50	7.42	66.92	18
Hudson	703.8	163.5	867.3	889	39.3	349	¾	15	52.35	6.75	59.10	21
College No. 1	725.2	113.7	838.9	878	35.9	315	⅞	17	53.55	7.03	60.58	20
Rucker	554.5	127.9	682.4	712	41.6	296	¾	15	44.40	5.20	49.60	23
Truitt	504.8	277.2	782.0	791	35.3	279	1	18	50.22	6.40	56.62	22
Acala (Watson)	540.3	177.7	718.0	731	34.1	249	1 ⅛-1 3-16	28	69.72	6.02	75.74	13
Acala (Nunn)	583.0	170.6	753.6	765	36.1	276	1 1-16	22½	62.10	6.11	72.21	15
D. & P. L. No. 2	519.0	227.5	746.5	764	34.9	266	1⅛	27	71.82	6.22	78.04	10
Lone Star 132-48-61	689.6	142.2	881.8	948	30.7	291	1 3-16	29	84.39	8.21	92.60	3
Lone Star 132-48-79	774.9	142.2	917.1	937	30.5	285	1 3-16	29	82.65	8.15	90.80	4
Express 433	703.8	142.2	846.0	860	27.8	239	1 3-16	29	69.31	7.76	77.07	12
Express 122-433-79-81	689.6	156.4	846.0	891	27.9	248	1 3-16-1 ¼	30	74.40	8.03	82.43	8
Express 350-64	696.7	135.0	831.7	867	28.8	249	1 ⅛-1 3-16	28	69.72	7.70	77.42	11
Express 412-79	644.5	163.5	718.0	731	26.4	192	1 3-16	29	55.68	6.73	62.41	19
Foster x Express 81	618.5	170.6	789.1	825	28.2	232	1⅛	27	62.64	7.41	70.05	17
Delfos 6102	774.9	213.3	988.2	1008	31.5	317	1 3-16	29	91.93	8.63	101.26	2
Delfos 698	745.5	199.0	945.5	976	32.9	321	1 3-16	29	93.09	8.18	101.27	1
Foster 11-817	703.8	156.4	860.2	868	25.8	223	1¼	34	75.82	8.06	83.88	7
D. & P. L. No. 3	632.7	170.6	803.3	812	28.1	228	1¼	34	77.52	7.30	84.82	6

TABLE III. HILL LAND COTTON VARIETY TEST—COLLEGE—1921.

VARIETY	Seed Cotton per Acre	Seed Cotton Perfect Stand	Lint per cent	Lint per Acre	Length of Lint	Value of Lint per lb. in Cents	Value of Seed at $25.00 a Ton	Total Money Value	Rank in Money Value	Strength of Staple	Character of Staple
Simpkins	560.9	602.	37.8	229.5	⅞	15	4.65	39.08	11	Poor	Poor
Miss. Sta. Trice	629.	690.1	31.2	215.3	1	17	5.93	42.53	10	Fair	Fair
Wannamaker-Cleveland	577.9	651.8	37.5	244.4	⅞	17	5.09	46.63	7	Fair	Fair
Cleveland 37w-54	610.6	631.9	35.7	225.5	⅞	17	5.08	43.41	9	Fair	Fair
Piedmont Cleveland	612.0	78.7	35.4	240.2	⅞	16	5.49	43.92	8	Poor	Fair
Cleveland Big Boll	464.3	604.9	35.2	212.9	⅞	16	3.65	37.71	12	Weak	Poor
Half & Half	532.5	568.0	44.0	249.9	⅝	.....	3.97	.....	....	Fair	Fair
Lone Star (Ferguson)	572.2	627.6	36.7	232.3	1-1 1-16	22½	4.94	57.20	2	Fair	Good
Lone Star 11-65	535.3	657.4	34.5	226.8	1-1 ⅛	24½	5.38	60.93	1	Good	Fair
Triumph	505.5	596.4	37.3	222.4	1-1 1-16	23	4.67	55.82	3	Good	Good
Miller	505.5	586.4	34.2	200.5	1-1 1-16	22	4.82	48.93	6	Fair	Fair
Delfos 6102	504.5	586.4	32.4	190.0	1 1-16-1 ⅛	24½	4.95	51.50	4	Fair	Good
Express 432	484.2	668.0	32.1	179.1	1 1-16-1 ⅛	25	4.73	49.50	5	Good	Good

Hill Land Variety Test.—This test was planted on poor hill land. Fair stands were secured, and a good yield considering the soil. Table III gives the main results from the test. It will be seen that the length, strength, and character of the staple is inferior to the staple of the same varieties in other tests. This can probably be attributed to the less fertile, dryer soil on which the cotton was grown.

TABLE IV. ALL STATION COTTON VARIETY TEST—1921.

	College Seed Cotton	Rank	Delta Seed Cotton	Rank	Holly Springs Seed Cotton	Rank	Raymond Seed Cotton	Rank	Poplarville Seed Cotton	Rank
Simpkins	1416	7	1433	7	2466	6	911	18	1746	6
Bank Account	1169	23	1400	8	2120	21	963	12	1377	17
Miss. Sta. Trice	1507	3	1683	1	2304	13	947	14	1647	9
Wannamaker—Cleveland	1477	4			2489	5	907	20	1449	15
Cleveland 37w-54	1548	2	1555	3	2512	3	1026	5	1530	11
Piedmont Cleveland	1613	1	1495	4	2397	8	1018	7	1899	3
Cook 1010	1380	10	1492	5	2304	14	887	22	1683	7
Half and Half	1339	14	1273	14	2281	16	987	10	1746	5
Cleveland Big Boll	1422	6	1173	18	2178	18	907	19	1305	19
Miller	1453	5	1225	16	2558	1	1030	4	918	24
Triumph	1327	17	753	21	1590	24	903	21	1647	8
Lone Star (Ferguson)	1406	8	773	20	2293	15	756	24	1098	22
Lone Star 11-65	1270	22	1295	13	2316	12	999	8	1980	1
Acala No. 5.	1303	19	1256	15	2085	22	1078	1	1017	23
D. & P. L. No. 1	1285	21	1355	11	2512	4	987	9	1484	13
Express 432	1371	11	1178	17	2373	10	967	11	1152	21
Express 432-782	1370	12	1355	10	2327	11	931	17	1818	4
Express 433	1297	20	1375	8	2397	9	963	13	1539	10
Express 350-718	1327	15	.....	....	2420	7	1034	3	1422	16
Delfos 6102	1315	18	1608	2	2546	2	1038	2	1926	2
Delfos 631	1398	9	1313	12	2178	19	1018	6	1467	14
Sunpress	1327	16	1443	6	2212	17	947	15	1503	12
Webber 49-4	1045	24	1150	19	1843	23	760	23	1359	18
Delta Type Webber	1365	13	.....	....	2131	20	935	16	1188	20

All Station Variety Test.—Table IV gives the yield of seed cotton per acre for the varieties grown at the different Experiment Stations in the State. This table is of interest in that it gives comparative yields of the same varieties when grown in different parts of the State, but it must be borne in mind that the different varieties differ greatly in lint percentage and length of staple. Consequently, the rank in real value may be considerably different from that shown in Table IV. However, by re-

ferring to Table I, which gives complete data for the different varieties, an estimate of their value at the different Stations can be made. (Detailed results from each station will be published by each station individually.)

Blooming Records.—Bloom counts were made on a hundred plants of each variety during the entire blooming period. There was not much difference in the dates of beginning flowering. The first blossoms were found on Miss. Sta. Trice and Half and Half on June 22. By June 28, all varieties had open blossoms. There was, however, considerable difference in the blooming rate at different periods during the season. The blooming season was divided into four periods, the number of blossoms produced in each being shown in the different columns in Table V. It will be observed that certain varieties, as Miss. Sta. Trice, Delfos 6102, and certain strain of Express produced a much higher percentage of their blossoms during the first period than other varieties. This is doubtless a decided advantage in regions of heavy boll weevil infestation. There was considerable difference, too, in the total number of blossoms as shown by Table V. In general, the most prolific blooming strains are high yielders.

TABLE V. BLOOM RECORDS, FIRST VARIETY TEST, COLLEGE, 1921

VARIETY	Number of Blooms and Percentage of Total								Total Blooms June 22-Aug. 11
	June 22 July 9	Percentage	July 10 July 27	Percentage	July 28 Aug. 5	Percentage	Aug. 6 Aug. 11	Percentage	
Simpkins	170	14.7	550	47.7	326	28.3	106	9.2	1152
Bank Account	198	15.8	624	49.9	291	23.3	137	10.8	1250
Miss. Sta. Trice	400	22.8	983	56.1	287	16.4	83	4.7	1753
Wannamaker-Cleve.	210	14.1	694	46.5	457	30.6	133	8.9	1494
Cleveland 37w-54	295	18.0	840	51.2	382	23.3	124	7.6	1641
Piedmont Cleve.	259	18.5	708	50.5	315	22.5	121	8.6	1403
Cook 1010	208	16.1	645	50.1	313	24.3	122	9.5	1288
Half and Half	156	11.4	721	52.7	358	26.2	134	9.8	1369
Clev. Big Boll	182	12.7	704	49.2	411	28.7	134	9.4	1431
Miller	167	15.1	527	47.7	335	30.3	75	6.8	1104
Triumph	162	16.6	519	53.1	239	24.4	58	5.9	978
Lone Star, Ferg.	156	14.6	561	52.3	278	25.9	77	7.2	1072
Lone Star 11-65	288	20.3	791	55.9	274	19.4	63	4.4	1416
Acala No. 5	265	21.4	589	47.5	309	24.9	76	6.1	1239
D. & P. L. Co. No. 1	229	14.4	666	41.8	524	32.9	174	10.9	1593
Express 432	307	20.2	640	42.1	411	27.0	162	10.7	1520
Express 432-782	291	18.9	681	44.2	448	29.1	122	7.9	1542
Express 122-433	286	15.6	810	44.3	615	33.6	119	6.5	1830
Express 350-718	267	17.2	723	46.7	431	27.8	128	8.3	1549
Delfos 6102	380	19.4	1079	55.2	391	20.0	104	5.3	1954
Delfos 631	255	17.1	778	52.1	351	23.5	108	7.2	1492
Sunpress	314	19.7	741	46.4	443	27.8	98	6.1	1596
Webber 49-4	184	14.6	693	55.0	321	25.5	61	4.8	1259
Deltatype Webber	244	21.2	651	56.5	197	17.1	61	5.3	1153

Nitrogen Fertilizers for Cotton.—An attempt was made to compare the efficiency of four nitrogen carriers when used as fertilizer for cotton. The calcium cyanamid and cotton seed meal were applied before the crop was planted and the others as a side dressing, just as the first squares were forming. All were applied at the rate of 15 pounds of available nitrogen per acre. This rate was obtained by applying 100 pounds of 15% nitrate of soda; 75 pounds, 20% ammonia sulfate; 62.5po unds 24% calcium cyanamid; and 215 pounds, 7% cotton seed meal per acre.

TABLE VI. NITROGEN FERTILIZERS FOR COTTON.

FERTILIZER	Pounds of Seed Cotton Per Acre		Cost of Fertilizer per Acre	Date Applied
	Total	Increase		
Ammonium sulfate	1323.0	154.7	$3.00	May 27
Nitrate of soda	1355.3	187.0	$3.50	May 27
Calcium Cyanamid	1341.8	173.5	$2.71	Mar. 23
Cottonseed meal	1173.0	4.7	$3.44	Mar. 23
None	1168.3			

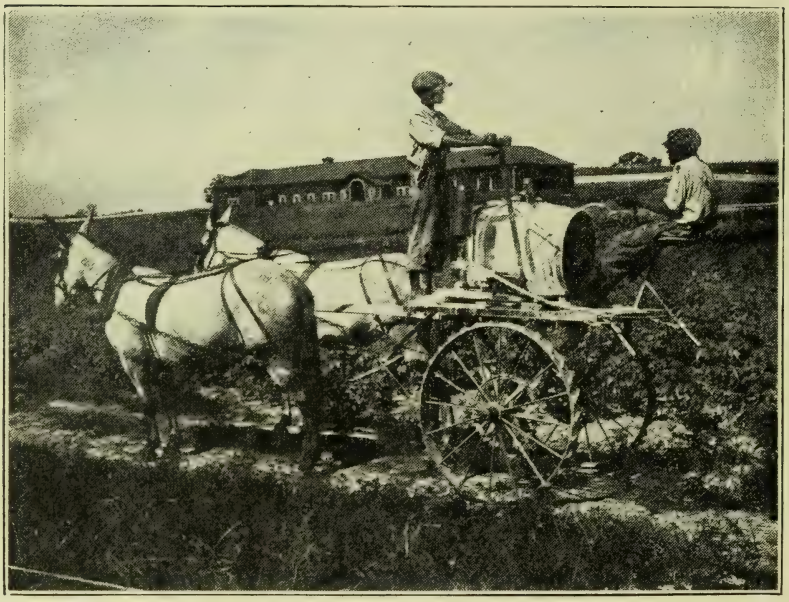
From the table the relative gains and costs can be seen. With seed cotton having a lint percentage of 33 1/3 and the lint selling at 16 1/2 cents per pound, the gain above cost of fertilizer, excluding expense of application, was $6.82 for calcium cyanamid, $6.78 for nitrate of soda, and $5.51 for ammonium sulfate. Cottonseed meal was unprofitable. As fertilizer prices vary from year to year the choice of the one to use will dedepd largely on which offers available nitrogen the cheapest. Whether any fertilizer will be profitable will depend largely on the needs of the soil in question, the price at which the cotton is sold, and the cost of the fertilizer.

BOLL WEEVIL POISONING WORK IN 1921.

Boll weevils appeared in the College cotton fields as early as June 13. It was decided to use the ordinary calcium arsenate dust-spray. Some of the plats were dusted on the night of June 24, but the unusually dry season prevented sufficient dews for continuing this sort of work. Later the poison was applied in a water solution or in solution of syrup and water.

For applying the poison in a water solution an Aspinwall sprayer was mounted on a two-wheeled cart suitable for this work. Figure 1 shows this outfit ready for use. The advantages of the liquid spray are (1) It can be applied at any time of day, thus removing the necessity for night work. (2) Applications can be made at regular intervals even if there is no dew, and (3) Not as much poison falls to the ground, or floats away. The disadvantages are (1) A large quantity of water is required, necessitating frequent refilling of the tank. (2) The spray cannot be made to reach all sur-

FIG. 1.—BOLL WEEVIL POISON SPRAYER AT WORK.



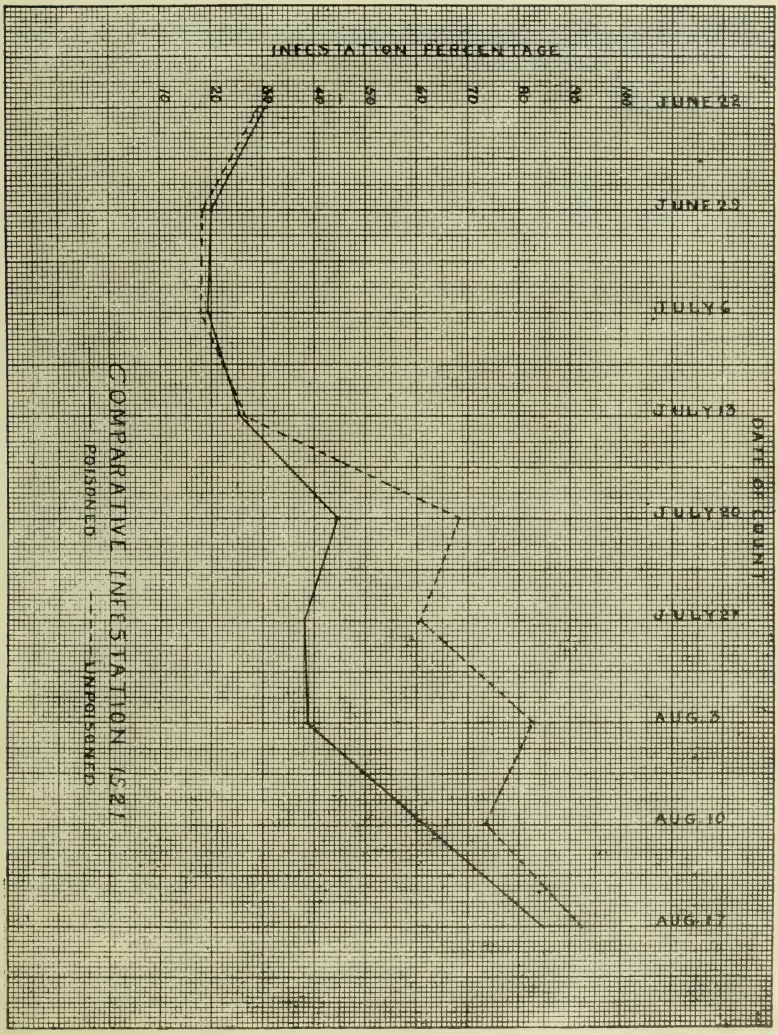
faces of the plant as a fine floating dust spray does, and (3) more labor is required to operate the liquid spray outfit. In the greater part of this work ten pounds of poison was dissolved in fifty gallons of water which ordinarily covered about two acres.

A comparison was made between the water spray just described and a syrup solution made by mixing 1 pound of calcium arsenate, 1 gallon of black strap molasses, and 1 gallon of water. This solution was applied to a part of one patch with a Knapsack sprayer and a very heavy application of poison was the result. Several other patches were treated with a weaker solution consisting of 10 pounds of calcium arsenate, 5 gallons of molasses, and 45 gallons of water, which was applied with the Aspinwald sprayer at the rate of about 5 pounds of poison per acre. The molasses solution is more expensive and disagreeable to handle than the water solution. However, the poison seemed to adhere better and was sometimes visible after light showers had removed poison applied in other forms.

As a general rule patches receiving poison yielded more seed cotton than the unpoisoned patch left for a check, but because of varying soil conditions, no direct comparison between yields can be made. Figure 2 shows infestation percentages at different dates for the unpoisoned check and all patches poisoned with the water solution. The former is based on the averages of four different counts made in fourteen different patches poisoned with calcium arsenate and water. The work on June 24 covered only

a few of the patches and produced no perceptible effect. Thereafter, the infestation counts remained about the same until work was begun with the water solution July 18.

FIG. 2.—INFESTATION CHART.



The comparison between the molasses-water solution and water solution showed a difference of 213.4 pounds of seed cotton per acre in favor of the part treated with the molasses-water solution. A considerable portion of this difference, however, was due to the fact that plants were much more infected with wilt in the acre treated with the water solution. The

infestation counts also showed differences in favor of the solution containing syrup but a part of these differences might have been due to the large amount of poison applied. Results in the patches treated with the weaker syrup solution were not so marked but the initial infestation was higher and hence, not so easily controlled.

Results obtained the past season show that applications of poison did help to hold the infestation down for a while. It seems likely, however, that with all other factors as they were, gains due to poisoning did not pay for the cost of materials and labor. There seems to be some merit in the use of syrup with the poison but this may not be sufficient to offset the additional expense.

Incidentally it was observed that 5 tons of manure per acre produced 645 pounds more seed cotton per acre than did the same kind of soil receiving no fertilizer. No poison was applied in either case. From this it seems safe to conclude that for our conditions, the use of stable manure or of proper commercial fertilizers is a more efficient means of growing a crop of cotton in spite of the weevil than any combative measures now available.

Grow One Good Variety in a Community.—Cotton growing interests might be furthered considerably if but one variety were grown in a community and that one a uniform variety with satisfactory lint. When but one variety is grown there is but very little chance for mixing at gins, or in the field by insects. Without this mixing, deterioration of the variety as it is grown from year to year is much less.

With but one uniform variety in a community, it is an easy matter for a classer to get together a quantity of cotton of like grade and staple length, and by shipping cooperatively, the grower can get the highest market price.

Our present system of cotton marketing is faulty and works disadvantageously to both the grower and consumer. Most of the cotton grown is sold to local buyers who pay practically no premium for better staple. They buy on grade alone and are careful to give themselves a safe margin. Since the grower is likely to get no more per pound for cotton of good staple length than he would for mixed, inferior staple, there is no inducement for him to grow better cotton and consequently the tendency is for him to grow the variety that will yield him the most lint even if the lint is inferior. The mills cannot pay top prices for inferior or mixed staple for their losses are greater when such cotton is used. Consequently, lower prices prevail and the grower is the one that suffers worst. The local buyers blame the growers for not growing better cotton, but they and the system are more at fault than the growers.

The ideal system is to grow but one good variety in a community as was mentioned above, and to market co-operatively. The bales should be assembled, graded by a competent classes, pooled and sold in quantity. This will insure the highest market price and eliminate the middleman.

STATE COTTON CROP REPORT*

	1921	1920	1919	1918	1917	1916
Number of acres..	2,665,385	2,793,000	2,950,000	3,132,000	2,788,000	3,110,000
Average yield per acre pounds of lint	156	151	154	187	155	125
Number of bales 500 lbs. gross weight	870,000	885,000	961,000	1,226,000	905,000	812,000
Average price per lb. Dec. 1 cents		14.8	37.5	27.8	28.5	24.5

The Mississippi cotton crop in 1921 was the smallest in twelve years with the exception of the year 1916. The crops for 1910, 1911, 1912, 1913, 1914 and 1918 exceeded a million bales each year.

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*Taken from reports made by J. A. Ramey, State Agricultural Statistician for the United States Bureau of Crop Estimates.

SOURCE OF SEED.

Below is a list of the sources from which seed of the varieties tested in 1921 were obtained:

Acala No. 5.—Nunn Seed Co., Porter, Okla.
Acala, Watson—Watson Seed Farms, Waxahatchie, Texas.
Allen's Big Boll—L. C. Allen, Hoschton, Ga.
Bank Account—H. G. Hastings Seed Co., Atlanta, Ga.
Cleveland (Wannamaker)—Model Seed Farm, St. Matthews, S. C.
Cleveland (Piedmont)—Piedmont Pedigreed Seed Farms, Commerce, Ga.
Cleveland Big Boll—J. R. Cleveland, Stratton, Miss.
Cleveland 37W-54—Mississippi Experiment Station.
Cook, 1010—J. T. Williamson, Auburn, Ala.
College No. 1—College of Agriculture, Athens, Ga.
Delta-Type Webber—Pedigreed Seed Co., Hartsville, S. C.
D. & P. L. Co. No. 1—Delta and Pine Lands Co., Scott, Miss.
D. & P. L. Co. No. 2—Delta and Pine Lands Co., Scott, Miss.
D. & P. L. Co. No. 3—Delta and Pine Lands Co, Scott, Miss.
Express (all strains)—Delta Branch Experiment Station, Stoneville, Miss.
Delfos (all strains)—Delta Branch Experiment Station, Stoneville, Miss.
Foster x Express-81—Delta Branch Experiment Station, Stoneville, Miss.
Hudson—R. E. Hudson, Auburn, Ala.
Half and Half—B. F. Summerour, Norcross, Ga.
Lone Star, 132-48-61—Delta Branch Experiment Station, Stoneville, Miss.
Lone Star, 132-48-79—Delta Branch Experiment Station, Stoneville, Miss.
Lone Star, 11-65—Mississippi Experiment Station.
Lone Star (Ferguson)—Ferguson Seed Farms, Sherman, Texas.
Miller—Mississippi Experiment Station.
Rucker—Rucker Cotton Seed Co., Alpharetta, Ga.
Simpkins Ideal—W. A. Simpkins, Raleigh, N. C.
Sunpress—Mississippi Experiment Station.
Trice (all strains)—Mississippi Experiment Station.
Triumph—A. D. Mebane, Lockhart, Texas.
Truitt—T. B. Truitt & Son, Waxahatchie, Texas.
Webber-49-4—Pedigreed Seed Co., Hartsville, S. C.

Note.—Foster 631, Foster 698. Foster 6102, Sunflower X Express *1, and Trice 270-41, which are varieties developed by the Mississippi Experiment Station, have been renamed respctively Delfos 631, Delfos 698, Delfos 6102, Sunpress, and Miss. Sta. Trice.

Bulletin No. 206 December, 1921

The Sweet Potato for South Mississippi

By

E. B. Ferris and F. B. Richardson

Mississippi Agricultural Experiment Station
AGRICULTURAL COLLEGE, MISSISSIPPI
J. R. Ricks, Director

The Sweet Potato for South Mississippi

By E. B. FERRIS and F. B. RICHARDSON.

Introduction.—For twenty successive years this Station in its two locations in South Mississippi has done more or less work with sweet potatoes, largely, it is true, in growing them as a commercial crop, but interspersing many experiments with varieties, fertilizers, storage and other tests necessary to meet the growing demand for information about this most valuable root crop. In its early location at McNeill our Station had newly cleared lands which were free from noxious grasses and inimical diseases and especially adapted to growing maximum yields of sweet potatoes at a minimum expense for labor.

At that time practically nothing had been done in South Mississippi toward growing this crop for outside markets and ours was possibly the first attempt at selling sweet potatoes in car lots to markets without the State. In 1906 our Station shipped from McNeill to Birmingham, Ala., three carloads of sweet potatoes, while local growers, encouraged by work we had previously done, added many more cars to the total number sent out from this small village and neighboring towns took up the work so that the sweet potato has now become a crop of considerable commercial importance in that part of the county contiguous to McNeill.

History.—Both sweet and Irish potatoes are of American origin, the sweet potato having been known and used for food before the Irish potato was discovered. It is said to have been introduced into Southern Europe many years before Sir Walter Raleigh introduced the Irish potato into England and then to Ireland. However, the white potato became the standard food crop of Ireland while in Southern Europe the growth of the sweet potato was largely discontinued for the reason, it is said, that they were too sweet for vegetables and not sweet enough for fruits. At present the growth of the sweet potato is confined largely to the southern part of North America, to Central America, the West Indies, Hawaii, and the Philippines. In no place are conditions more favorable to their growth than along the Atlantic Seaboard from New Jersey to Texas on Coastal Plains soils, particularly in the States of Alabama, Georgia and Mississippi as the census figures of production indicate.

Statistics.—Mississippi ranks third as a sweet potato growing state having produced in 1920 11,330,000 from 103,000 acres of land devoted to the crop. At the same time Alabama produced 17,764,000 bushels on 180,000 acres and Georgia 13,764,000 on 148,000 acres. There are produced annually in the United States 112,268,000 bushels of sweet potatoes and 430,458,000 bushels of Irish potatoes. Those of us who are accustomed to the sweet rather than the white or Irish potato greatly prefer the former on account of its palatability, and as experiments show the fuel value of the sweet potato when taken into the digestive system in the proportion of 560 calories in the one to 375 calories in the other, it would seem entirely possible and even probable that with better methods of handling and advertising the sweet potato might reverse positions with the Irish potato in the relative rates of consumption even though the latter might still be used in as great quantities as at present. If such should ever be the case the Coastal Plains soils of South Mississippi would come to their true

value as the most economical producers of the cheapest and best food for the human race.

Importance of Crop.—Because in the past a large part of the sweet potatoes actually grown have spoiled because of improper methods of curing, this crop has never been given the place in our farm economy that it deserved and this, too, rendered the extension of markets for the best varieties extremely uncertain so that until recently the trade has not been warranted in conducting any extensive advertising campaigns for extending these markets. However, with the introduction of the modern curing house, and the finding out that much of the decay in sweet potatoes was caused by preventable diseases, the keeping quality of the sweet is fast approaching that of the Irish potato and would appear to be only a question of time when it may become just as important an article of human consumption. Besides, the sweet potato is much more palatable to domestic animals than the white and to the extent of furnishing a carbonaceous diet is possibly not exceeded in acre value by any other feed crop that can be grown in South Mississippi. Based on a yield of 20 bushels of corn and 200 bushels of sweet potatoes to the acre, the potatoes would furnish approximately 50 per cent more protein and three times more carbohydrates than the corn and on the sandy lands of this section could be harvested by the hogs with no material injury to the land.

Climatic Requirements.—To be grown to best advantage the sweet potato should have a growing season of about five months. For home use its growth might extend to fully half the area of the United States including the states of Pennsylvania, Ohio, Indiana, Illinois, and parts of Iowa, Nebraska, Colorado, New Mexico, Arizona and California. A map showing the range of production for the crop as contained in Farmers' Bulletin No. 304 shows that it hugs the shore line of the Atlantic Ocean and Gulf of Mexico from New Jersey to Texas, covering the Coastal Plains soils of the several states between them and in the approximate center of this wide belt extending far north so as to include the greater part of all the states south of the old Mason and Dixon line. It is enough, however, for our purpose to say that the State of Mississippi is entirely within this belt and that sweet potatoes may be grown to perfection over the whole State so far as climatic requirements are concerned and, as a matter of fact, they are so grown; but, we regret to say, only to a very small fraction of the amounts that might be grown if markets were available and improved methods of curing the crop in more general use, with the elimination of black rot and stem rot from field and seed bed, the careful handling, housing and curing of the potatoes when grown, there should be no more doubt about the successful keeping of sweet potatoes than that of keeping the white potato. When this is assured the marketing of these potatoes would be extended over the entire year rather than over a few months of fall and winter and with proper propaganda for advertising this wonderful crop, such as has been repeatedly done by producers of other crops, notably the fruit crops of California, markets would soon be found for much greater quantities of these potatoes than we grow at present and would consistently increase in proportion to our efforts.

South Mississippi Soils.—The most of the soils of South Mississippi are especially suited to the growing of sweet potatoes. They are generally sandy loams, well drained, easily prepared and cultivated and ideal for the develop-

ment of smooth potatoes of medium size, the kind that sell best on discriminating markets. Poorly drained, stiff lands should be avoided at least to the extent of attempting to grow potatoes on a commercial scale. Only a very small per cent of the soils of South Mississippi have ever been brought into cultivation, possibly not more than five per cent. over the section as a whole and millions of acres of choice lands now have been denuded of their growth of pine timber and await development at the hands of the farmers. Comparatively speaking the sweet potato is the best crop that can be grown on such newly cleared lands. They make almost as heavy yields on new lands as they do when these lands are older and better developed mechanically and chemically; such new soils are free from diseases peculiar to the sweet potato, especially the black rot with which many of our older soils are infected; crab grass infests many of the older soils of the South and especially those of the Coastal Plains section and might be called the arch enemy of the sweet potato in that it runs the cost of cultivation to unreasonable bounds compared to that of new lands which for several years after clearing are free from this pest; besides, the majority of staple farm crops grown in South Mississippi do not thrive on newly cleared lands and the sweet potato is one of the few exceptions to this rule.

Think of the possibilities for such a crop in a section like our own where the seasons are long, rainfall abundant and ideal soils available to the extent of millions of acres. There are approximately ten million acres of Coastal Plains soils in South Mississippi, not five per cent. of which are in cultivation and the most of which might be made to grow maximum crops of sweet potatoes immediately after clearing. The best of these lands will, with the addition of only a few hundred pounds of commercial fertilizer, make yields of two hundred or more bushels of sweet potatoes per acre which in the present time of depressed values are selling field run to the canning factories for forty cents per bushel and which, if stored and cured, will sell in the late winter for more than one dollar per bushel. The same newly cleared lands if planted to corn would do well to produce twenty bushels per acre, would require fully as much expense to grow and would sell on present markets for little more per bushel than the sweet potatoes.

In many instances in our Station work we have grown ten times as many bushels of sweet potatoes on newly cleared lands as the same lands produced later when planted to corn and while two hundred bushels of sweet potatoes per acre is nearly twice the average of the State we have in many instances exceeded this yield by many bushels. As generally grown the sweet potato is made to follow other crops and consequently planted too late for maximum yields; setting is frequently done by inexperienced hands in great haste to take advantage of occasional showers and is often hastily done on poorly prepared land on time borrowed from that intended for corn and cotton. Notwithstanding poor preparation, late planting and generally poor stands, the average yield of sweet potatoes for Mississippi as a whole is about 110 bushels per acre while that of corn for the same years was sixteen.

Soil Requirements.—The sweet potato does best on sandy loam soils with sufficient clay in the subsoils to prevent the leaching of added plant food. Frequently the soils that most nearly meet these physical requirements are lacking in chemical plant food necessary to maximum production. Thus, in perhaps the majority of sweet potato soils, the use of commercial fertilizers is found to be

necessary. It is said that extremely rich delta soil is not adapted to the growth of the sweet potato though doubtless such soils will produce enough for home use. Soils made extremely rich by the application of animal manures have proven inferior for potatoes even in this section for the reason that the potatoes grow too large and both large and small ones crack open and are consequently fit only for feeding to animals and when stored have not kept well. On one occasion the writer had two acres of as fine potatoes as were ever grown at McNeill ruined entirely from having been grown on land highly fertilized with animal manures, placed the previous winter and immediately followed by an early truck crop. On this land the potatoes grew to an enormous size and many of them were cracked open to the extent that they could be divided with the hands by spreading the cracks already started.

Fertilizers.—As previously indicated the sweet potato often does best on lands below the average in fertility and made productive by the use of fertilizers. It has been our experience that it is a crop that does not require high fertilization and some of our most satisfactory yields have been made on newly cleared lands with moderate amounts of commercial fertilizers. The crop does not seem to respond to changes in kind and quantity of fertilizers as freely as does cotton and some other farm crops and the work that we have done first at Mc Neill and later at Poplarville with fertilizers under potatoes does not lead to any very positive conclusions on our part. A study of the fertilizer work carried on at other Southern Stations would also fail to lead us to any very definite conclusions as to how the crop should be fertilized. Thus in Florida as a result of carefully conducted fertilizer work extending over five years the most pronounced difference in yield due to fertilizers was the leaving off of potash from mixtures containing nitrogen and phosphorus. By so doing the yield as reported in Bulletin No. 156 of the Florida Experiment Station was reduced from 204 bushels with the complete fertilizer to 65 bushels where only nitrogen and phosphorus were applied. On the other hand one of the conclusions drawn from a number of cooperative tests conducted by the Alabama Experiment Station and reported in Bulletin No. 184 is, "Taken as a whole these experiments seem to indicate that the popular idea that potash is the most important constituent in a fertilizer for sweet potatoes is incorrect, at least as to practically all the soils here represented. On the other hand, these tests show that phosphate and nitrogen were much more important than potash."

While our Station was located at McNeill and before the soil had been influenced to any great extent by the application of fertilizers to other crops, we conducted a simple series of tests to show the effects of different plant elements alone and in combination on the yield of sweet potatoes. The land on which this was done was practically level and very uniform in character. Ten combinations were used each in duplicate and the several plats in the two series so placed as to do away as largely as possible with variations in yield due to inequalities in the soil, if perchance there should have been such, which we were unable to detect either before or after the work was done.

This work was started in 1906 and was repeated on the same land in 1907 with a considerable reduction in yield the second year over the first, but with no marked difference in the effects shown by the different kinds or combinations of plant food elements. One result alone was sufficiently marked to call atten-

tion to and that was the falling off of the check plat from 13,550 pounds in 1906 to 8,745 pounds in 1907, showing, as we believe, that the sweet potato is not a gross feeder and that the residue of fertilizer from previous crops was sufficient in 1906 to bring up the yield of the check plat almost to the level of those that had received fertilizer. However, this residue was largely used up in one year and the check plat in 1907 fell several thousand pounds per acre below the average of those receiving fertilizers.

We realize now that from a scientific standpoint it would have been much better if the work started at McNeill had been extended over a period of at least five years, but, as a matter of fact, no farmer ever attempts to grow potatoes more than twice in succession on the same land without interspersing other crops which he fertilizes according to their particular needs as he understands them, and so if this work had been continued it might have had little practical value.

Promptly on the removal of this Station from McNeill to Poplarville we began a much more elaborately planned experiment with fertilizers under sweet potatoes as suggested by a committee of horticulturists from the organization of Southern Agricultural Workers. This was started on land of unknown history and the results of the first two years were so conflicting that we do not give them here, though they have been published in our annual report for 1920. Doubtless much of lack of uniformity was brought about by the serious infection of the land with black and stem rots, and the presence of which caused us to abandon the experiment and start anew on supposedly clean land. This last work has been going on only one year and being on old land on which fertilizers have been used for a number of years the results of a single crop would be inconclusive.

The following table gives in detail the results of the two years work with fertilizers at McNeill. As each year's result is the average of duplicate tests, it would seem that fairly accurate conclusions might be drawn from a further average of the results of both years. At any rate we feel that the average grower of sweet potatoes on the Coastal Plains soils of South Mississippi will not go far wrong in using the ordinary cotton and corn fertilizers for sweet potatoes and that they will not require essentially larger applications than would be necessary on the same land for the most economical production of these two staple crops. The variety of potatoes used in the experiment was the Dooley Yam.

TABLE I.

Results from Two Years' Work with Fertilizers Under Sweet Potatoes.

No. of Plat	FERTILIZERS CALCULATED IN POUNDS PER ACRE	1906 Average yield of duplicate plats calculated in lbs. potatoes per acre	1907 Average yield of duplicate plats calculated in lbs. potatoes per acre
1	200 lbs. Cottonseed meal	14,320	11,385
2	200 lbs. Acid phosphate	16,000	11,660
3	200 lbs. Kainit	14,490	11,600
4	150 lbs. Acid phosphate 150 lbs. Cottonseed meal	14,820	12,320
5	150 lbs. Cottonseed meal 150 lbs. Kainit	14,300	11,990
6	150 lbs Acid phosphate 150 lbs. Cottonseed meal 150 lbs. Kainit	15,910	13,585
7	Check	13,550	8,745
8	150 lbs. Cottonseed meal 300 lbs. Acid phosphate	15,550	13,365
9	300 lbs. Cottonseed meal 150 lbs. Acid phosphate	14,830	12,705
10	150 lbs. Acid phosphate 150 lbs. Kainit	14,910	12,815

Selecting the Variety.

Before the discussion of this subject, the results of variety tests made at this Branch Experiment Station may be of interest and value to the reader. In the spring of 1914 seven varieties of sweet potatoes were planted here on land that had been given an application of animal manure the year before. The effects of this manure was to cause the potatoes to grow too large, to crack open badly and to keep poorly when put in the house. These seven varieties were grown in plats of one-tenth acre each and gave yields as follows, calculated in bushels of potatoes per acre: Bunch Yams 144; Gold Coin 174; Porto Rico 193; Early Triumph 167; Nancy Hall 93; Golden Yams 59; Dooley Yams 91.

An interval of two weeks elapsed between the setting out of the first four varieties and that of the last three varieties so that evidently they are hardly comparable. In numerous instances here in the past Dooley Yam potatoes have made as high as two hundred bushels per acre and while this variety has generally fallen below the Porto Rico, Triumph and Golden Coin in yields, the difference would be nothing like so great as indicated by the above results. Except that the Triumph does not sell so well on the Southern markets as the Doolies and Nancy Halls,—we prefer them here over any other kinds. The yields are heavier, the potatoes are more uniform in every way, they keep better and for home consumption are, in our opinion, the most desirable of all varieties that have been grown here.

Early in the year 1919 at the suggestion of and in collaboration with the extension forces of the State several bushels each of Nancy Hall, Porto Rico, and Triumph seed potatoes were treated with bichloride of mercury and bedded here. Slips from these potatoes were later used in a test to determine the relative yields of the several varieties as well as to conduct tests with fertilizers under a single one of these varieties. Mr. E. F. White, at that time Extension Horticulturist, obtained the seed potatoes for us from growers with whom he was acquainted, and we have never had any reason to doubt the purity of the varieties. Early in May of 1919 the field in which the variety work was to be done was fertilized with a mixture of two parts acid phosphate and one part cottonseed meal applied in the drill at the rate of about 400 pounds per acre, the rows being three and one-half feet apart, all were cultivated alike and equal areas of each were dug and weighed at two different times, August 28 and November 28, and yields calculated in bushels per acre, the potatoes at each time of digging being separated into two lots according to size which we designated as marketable and unmarketable.

In 1919 we had an abundance of slips to do all work outlined, but in 1920 our first bedding of these same varieties were so injured by continuous wet and cold weather extending into the early spring that all the first bedding rotted and there were not enough of the varieties left to give as many slips as were required to carry on experiments with varieties and fertilizers, hence we were compelled to cut the vines from the earlier plantings of Nancy Hall potatoes and this apparently greatly reduced the yields of this variery in 1920. We noted in this work during both years that the Nancy Hall potatoes had a tendency to die in the rows after the slips or vines had been set and had begun to grow. This tendency was much more pronounced with this variety than with either of the other two and we plan to have the plant pathologist do some co-operative work here another year in an effort to determine the true cause of this trouble with the hope that it may be corrected.

SWEET POTATO VARIETY YIELDS.

TABLE II.—SWEET POTATO VARIETY YIELDS (Given in Bushels per Acre).

VARIETY	HARVESTED AT MATURITY								Harvested for Early Market 1919 only (August 28)		
	1919			1920			Two years av. of total yields	Two years av. of Nos. 1 and 2			
	Marketable	Unmarketable	Total	Marketable	Unmarketable	Total			Marketable	Unmarketable	Total
Porto Rico	92	33	125	161 1–3	34 2–3	196	161 1–2	126 2–3	13	11	24
Nancy Hall	63	34	97	54 2–3	36	90 2–3	93 5–6	58 5–6	33	21	54
Triumph	117	40	157	157 1–3	53 1–3	210 2–3	183 5–6	137 1–6	31	23	54

In 1921, Triumph, Nancy Hall, and Porto Rico were again used. The plants were obtained late, and set July 8th, spaced 15 inches by 4 feet; harvested November 25th, before frost. Figuring the green potatoes at 60 lbs. per bushel, yields per acre were as follows:

VARIETY	MARKETABLE	CULLS	TOTAL
Porto Rico	120	35	155
Triumph	87½	35	113½
Nancy Hall	72½	41	113½

These yields are all low. In a fertilizer test of Nancy Halls, in the same field with the variety tests, check plats of this variety which had not received any fertilizer, averaged 316 bushels per acre of marketable potatoes. However, these were planted two weeks earlier than the variety test plat, and vine cuttings were used. Early planting is necessary for big yields.

Selecting the Variety.

In choosing the variety best adapted to a particular location, two main considerations must be kept in mind: (1) The value of the variety for its intended market, and (2) its adaptability to successful culture in the region where it is to be grown. Under the market considerations, the variety may be grown for the grower's use only; for the local market; for the shipping market; or for the canning factory. It should be needless to say that when sweet potatoes are grown for sale, the variety that the market demands should be grown, if it can be profitably cultivated in the locality. At present, the Dooley is the variety most in demand by the canning factories of this section; the firm texture of the meat holds together in canning, and presents an attractive appearance, outside of the high quality. However, it did not yield so heavily as Porto Rico and Triumph in past tests.

For home use, the selection of the variety is limited to personal taste, which is usually very discriminating. There are two general types to select from: (1) the dry, mealy-fleshed, such as Yellow Jersey and Big Stem Jersey; and (2) the juicy, sweet kinds, like Porto Rico, Nancy Hall, Triumph, and Dooley. For home use in South Mississippi, varieties of the second group only are grown; this statement also applies for the local markets of this section of the State. For these two market classes, the Dooley has led in the past, though in recent years Porto Rico has gained in favor as it has become more generally known, because of its superior high yields, and fine quality for general table uses. All the four moist-fleshed varieties named are well adapted to South Mississippi.

In establishing one of the juicy sweet potatoes on the Northern market, Southern growers have made only a small beginning. The Eastern producers of the dry-fleshed varieties grow only 15 per cent of the total sweet potato crop of the United States, yet statistics show that 85 per cent. of the sweet potatoes marketed come from this 15 per cent. section. In other words, the Northern market is a dry sweet potato market. The Eastern growers have attained this success through breeding up a good uniform variety, giving it good preparation for market, and forming a good selling organization to dispose of the product. The dry varieties have been given support by the grower, the shipper, and the

dealer. Nancy Hall has made some small gains on the Northern market, chiefly because of its color resemblance to the Eastern grown, dry-fleshed varieties. At the present, if we are to grow what the Northern market demands, it would be a dry-fleshed variety, as the Big Stem Jersey. However, this variety does not seem to be well adapted to the extreme South, because seed saved locally degenerate, or run out rapidly. Therefore, this condition would necessitate the buying of seed potatoes from the Eastern growers, an item adding considerably to the cost of production.

The salvation of the Southern producer of the superior, juicy-fleshed, sweet, sweet potato is dependent on at least three factors: (1) He must inform himself on the type of potato which is readily accepted on the market. This will be discussed later under "Marketing." (2) The potato must be properly cured. (Discussed under Storage.) (3) The Southern varieties must be promoted in the consuming markets by an intensive, well-supported system of advertising and selling. (See discussion under Marketing.)

With these factors accepted and rigidly adhered to by the Southern producers, they will be able to widely increase the use of the Southern varieties. At present, the truck growers in this State are confining their efforts to three varieties: Porto Rico, Nancy Hall, and Triumph. Triumph is used mainly for the green crop which is shipped in July and August; Nancy Hall has also been successfully used by one of the largest producers in this section of the State, and growers generally are finding that the Porto Rico is also adapted for early shipment. The selection between these three varieties will likely be Porto Rico, as it is already well established among growers, and from the past gains which this variety has made in acreage, it would not be surprising to see it used nearly exclusively as a truck farmer's variety. This concentration on one variety will help in development of better seed selection.

Seed Selection.

After the selection of the variety, one of the most important factors in successful crop production is the selection of the seed stock. While field selection of seed corn is a generally followed practice, selection of sweet potato seed at digging time, in the field, is a very rare practice. It is a practice, however, which must come into general use if the Southern producer of this valuable crop ever expects to maintain profitable production. As in corn, the individual plant, or hill, forms the basis of selection. The seed should be saved from fields free from disease, and preferably, from land on which potatoes have not grown previously. A disease-free crop can be best obtained by planting disease free cuttings on new land. An ideal hill from which seed should be saved would have the following characteristics: freedom from black rot, stem rot, and scurf; high production of uniform marketable-size potatoes; trueness to variety type. In saving seed from such hills, they had best be dug by hand, so that the hills may be kept separate, and each judged separately. Test each hill by splitting the stems; discard those whose stems are streaked with black inside. This method is being followed at this Experiment Station, and truck farmers who have seen this work in progress state that it is practical where seed must be saved for large acreages. It is certain that if the potato grower expects to produce high yields of the type of potatoes demanded on the market, he will have to adopt the method of hill-selection.

As a regular practice for systematic seed selection, a small patch of potatoes should be planted each year, grown from vines only, and in a location where potatoes have not been grown for at least four years. From this planting, potatoes from the best hills only should be saved, handled very carefully at digging to avoid bruising, and placed in well ventilated crates for storage through the winter. These crates should be marked, so that they will not get mixed with the field run crop. In judging a hill for its production of marketable-size potatoes refer to the table of U. S. Market Grades quoted later.

Bedding.

The time for bedding in the open ground is after danger of frost, the exact date varying from the Gulf Coast to Meridian and Jackson, ranging from March 1st to April 15th on the average. For early plant production in hotbeds, bed the potatoes four to six weeks before the danger of frost is over.

Bedding Space Required.—When planting in the field 15 inches by 3½ feet, 10,000 plants will be required per acre. If an acre is to be set out at the first drawing, from eight to ten bushels of average size seed stock will have to be bedded. If three drawings are to be depended upon, as is usually the case, three bushels of seed under good conditions should be sufficient. This amount of average size seed will require about thirty-six square feet of bedding surface, making a bed four feet wide by nine feet long. For the later crop grown from vines, only one-sixth of the area to be planted needs to be set with plants or draws. Thus, to set out an acre of potatoes from vines, one-sixth of an acre should be set in draws, requiring about 1,700. This number of draws under good conditions will be furnished by a half bushel of potatoes at three drawings. Figure 12 square feet of bedding space per bushel of average size seed stock.

Location, Construction, and Management of Plant Bed.—Locate the bed on a well-drained piece of ground, sloping to the south, and protected on the north by a windbreak of trees or buildings if possible. For an open bed, loosen the soil to a depth of five or six inches, and rake smooth. If the soil has grown potatoes before, it will be necessary to excavate and discard the soil to a depth of six inches, and replace with pure sand, or sandy loam, from a place where potatoes have never been grown. Place the potatoes on the smoothed surface as close as possible without touching each other, and cover one inch with pure sand. Water the bed thoroughly. When the plants begin to show through the soil, add two inches more of sand so as to establish a good root system to the plants.

For a manure-heated hotbed, start two weeks in advance of the time for bedding the potatoes, to prepare the manure. Fresh horse manure containing a fair amount of litter should be heaped up outside of the barn and allowed to heat. If the manure is dry, moisten it with water while it is being piled. As soon as the heating has well started, fork the whole pile over and stack it again. When the whole mass gets to heating through evenly, it may be placed in the hotbed pit. This pit should be at least eight inches deep, and slightly wider and longer than the frame itself. The frame for this pit should be twelve inches high on the north side, and six inches high on the south, so as to give a slope towards the sun, and also to give water drainage to the hotbed cover. Bank manure and soil around the outside of the frame, so as to drain away any excess

of water. The eight inch layer of manure should be well packed, and then covered with three inches of pure sand, or sandy loam. Do not bed the potatoes until after three or four days, on account of the high temperature developed at first by the manure. The hotbed cover may be of glass sash, or cloth. If cloth is used, heavy unbleached muslin will be satisfactory. A roller for this cloth will help in opening up the bed for full light and ventilation.

Fire-heated hotbeds are often used for forcing sweet potatoes where a large quantity of plants are wanted. The bed may be 50 to 75 feet long, and four feet wide. It is usually placed on a slight slope of a hill, so as to give an upgrade for the flue from the firepit to the smokestack. The flue is made by digging a trench lengthwise of the bed, 18 inches wide and eight inches deep This should be covered with sheet iron near the fire pit, but farther out may be covered with boards. Near the fire pit, the soil on which the potatoes are bedded should be 12 to 15 inches deep, grading to three inches in depth at the smokestack end. The fire pit is made by digging out below the level of the flue, and covering over with heavy sheet iron and mound of soil.

Allow plenty of ventilation for the bed, and whenever the weather permits, remove the cover entirely.

Disinfecting the Seed.—All sweet potato seed should be disinfected before bedding by soaking it ten minutes in a solution of one ounce corrosive sublimate in eight gallons of water. Use a barrel or other wooden container for this solution. The potatoes may be placed in a sack or hamper and dipped in the mixture. This solution is very poisonous if taken internally, and it should be thrown away immediately after getting through with it.

Drawing the Plants.—These are drawn by hand, holding the bedded potato in place with one hand, and removing the plants with the other. Good, stocky plants six or more inches long should be drawn, leaving the smaller ones until later. Four or five drawings can be made under good conditions, averaging seven to ten days apart.

Field Management.

The potato field should be a well drained piece of land. Low, poorly drained land often causes the potatoes to crack, or check, making unsalable stock. A deep soil is required, for best results, therefore plowing should be done at least seven or eight inches deep. This plowing should be done at least a month before planting time, so that all vegetable matter from the preceding crop will be decayed, or at least, in a rotting condition. If there is much trash on the land from the preceding crop, precede the plowing with a thorough discing.

Before planting, smooth the surface with a disc harrow followed by a smoothing harrow. Mark off the rows with a broad shovel, and apply the fertilizer by hand, or with a fertilizer drill. If it is applied with the fertilizer drill, a narrow shovel following the drill will help to mix the fertilizer with the soil, and make it more quickly available. Bed on the fertilizer with a one horse turning plow, which will leave the beds eight to ten inches high. Immediately before planting, the tops of the beds can be smoothed down by a two horse drag or float, built large enough to drag four beds at once. This light dragging will leave the tops of the beds leveled off, and in fine condition for setting the plants.

Transplanting.—Horse drawn machines which have been used for this purpose in this section have not proved satisfactory, so that even on the largest acreages, the plants and vines are set out by hand. The most common tool used in placing the plants in the soil is a small stick similar to a walking cane, which has a V-shaped notch in the end used for pushing the plants into the soil. The plants or vines are distributed and spaced at the required distance ahead of the planters. Draws are dropped with the root system at the center of the ridge, where they can be easily pushed deep into the bed by the notched stick. In the case of vine cuttings,—which are eight to ten inches long,—the cuttings are laid across the bed, and the notched stick is placed over the middle of the cutting to force it into the soil. leaving both ends sticking out, Shorter cuttings can be used, and the base ends only forced into the soil. Either method is satisfactory, when properly done. In any case, both draws and vines should be planted deep. During unusually dry seasons at planting time, watering of the plants is practiced to good advantage. The potato grower should not be content with less than a perfect stand of plants; a little time devoted to replacing dead plants will be time well spent towards securing large yields.

Continuous, clean cultivation must be practiced from the time the plants are set out until the vines cover the ground. The cultivation should be done shallow, but often. Because of the rapid growth of vines well cared for, this period of cultivation is of relatively short duration.

Harvesting.—If the crop from draws has been given an early start for the green market in July and August, the potatoes should be dug when the market demands are most favorable. For storage, the potatoes should be mature before digging. This can be tested by breaking a potato; if the exposed surfaces continue to flow the milky sap, the potato is not matured sufficiently. If, on the other hand, the wounds dry and heal over within a few minutes, the potato is mature enough for storage. A few tests like this over the field will give a good idea of the average maturity. Of course, if the vines are killed by frost before sufficiently mature, no further growth can be made, and the grower should start harvesting operations at once. Delay of digging after frost will damage the keeping qualities of the potatoes in storage. The dry season occurring the latter part of September, in October and early November, before frost, is the ideal time for digging. When potatoes are to be marketed, digging during wet spells will make it impossible to pack the bright clean potato which is favored on the consuming market; also the keeping qualities will likely be impaired.

Digging operations will be much easier if most of the vines can be cleared from the rows. Some growers in South Mississippi use a hay rake, removing the bulk of the vines from two rows at a time. Here at the Experiment Station a mowing machine has been used ahead of the hay rake, with good results. The mower enables the rake to remove more vines. Either method is more economical than cutting the vines from the row with hoes. The vines which have been piled by the rake can be loaded at once on hay racks and hauled for feed to stock pens, or can be pushed out of the way into the middles of the rows. After this preparation, use a large middle-burster drawn by two large mules, opening up every other row. A turning plow is often used for this digging, but is not so satisfactory as the middle-burster. Take up the potatoes and place them back

carefully in the same furrow. **Do not throw them against one another.** Carelessness in this one operation is responsible for much of the failure of potatoes in storage. A bruised potato is much worse than a cut or broken one. The cut potatoes will heal perfectly in dry, sunny digging weather, but the bruised potato will carry its injury to the storage house, and multiply rot to sound stock.

After every other row has been opened and the potatoes picked up and laid back in furrows, the remaining rows can be completed. The potatoes should be allowed to dry in wind and sun before being hauled to the storage house. Potatoes should not be left out over night, and it is best to stop digging early in the afternoon to give all the potatoes a chance to dry before being carried to the storage house.

Bushel baskets, hampers, and crates are used for collecting the crop in the field. The potatoes should be field graded and stored in one of these types of containers, and should not be handled again until shipping season, when they must be graded again in the storage house. When the potatoes are picked up in the field and placed in the container, they should be **laid** in, not **thrown** in.

GRADING.—The sweet potato grades which have been worked out by the Bureau of Markets of the United States Department of Agriculture should be followed in the grading work. These grades, briefly stated, are as follows:

U. S. GRADE NO. 1.—Size, 1¾ inches up to 3½ inches in diameter. Length, 4 to 10 inches. Potatoes shorter than 4 inches are included in this grade if they are not less than 2¼ inches thick. This grade must consist of sound sweet potatoes of similar varietal characteristics which are practically free from dirt or other foreign matter, frost injury, decay, bruises, cuts, scars, cracks, and damage caused by heat, disease, insects (including weevils), or mechanical injury. U. S. GRADE NO. 2 must be free from serious damage by the causes listed above; the diameter may vary from 1½ inches to 3½ inches.

In order to allow for variations incident to commercial grading and hauling, five per cent. by weight of any lot may not meet the requirements as to diameter, and, in addition, six per cent by weight may be below the remaining requirements of the grade. The Jumbo Grade includes potatoes from 3½ inches in diameter up, and length.

For field grading, the crates should be distributed in the field at grading points, where the gatherers bring the potatoes to the ones doing the grading. One experienced grader will keep even with three gatherers. The grader places three crates along side each other, for the three grades, No. 1, No. 2, and Jumbos. All cut or damaged potatoes are discarded, and used immediately for stock feed. Crooked, badly shaped potatoes should also be discarded, and only good marketable potatoes should be carried to the storage house. Another method of field grading consists of every gatherer doing his own grading. One man is assigned to pick up No. 1's, another follows who gathers the No. 2's, and a third gets the Jumbo grade. This method requires one less handling of the potatoes, and is to be recommended for this feature. However, it is difficult to train all the pickers to be good graders. This objection is partially eliminated when it is considered that regrading is necessary before shipping.

Storage.

While storage pits, or banks, have been used very largely in the past for saving the sweet potato crop, the storage house is making rapid gains in recent years. The main disadvantages to the banking method of storage are (1) large loss due to decay; (2) the inconvenience of getting the potatoes when needed, especially in cold and rainy weather; (3) the annual labor involved in construction of these storage banks, when all hands should be giving their full time to harvesting operations. With reference to the first point,—the large loss due to decay, it should be said that this is not true where care in seed selection, sanitation of seed beds and fields, care in harvesting, and proper construction principles of building the storage bank, have been observed. A good storage house will not correct carelessness in production, harvesting operations, or frost injury before digging.

The storage house of the Experiment Station grounds is of standard construction, 20 ft. by 20 ft., ten foot wall, capacity of about 100 bushels in crates. Storage records were maintained on 50 bushels of Nancy Hall potatoes last winter, 1920-1921. The remainder of the crop had to be dug before the Storage House was constructed. On March 1st, only one fourth of one per cent. of these potatoes had been damaged by soft rot. For all practical purposes, perfect storage resulted.

Oak wood is used to heat this house. Coal is better, because of more even heating.

The essentials in the construction of a good storage for sweet potatoes, whether the storage is a dirt bank or the modern potato house, are (1) Insulation, which protects the stored product from rapid changes in temperature, and (2) Ventilation, which provides for a circulation of air. Artificial heat is not always necessary in this section of the State; in the mild winters, a well insulated house alone will keep the potatoes from freezing. However, it is essential to be provided with heating facilities for curing the crop, or so that the house may be heated on short notice.

Outdoor cellars have been successfully used in this State. These approach the regular storage house in construction and management. Their capacity is limited to small crops. One of these cellars was excavated from a steep hillside, roofed over and covered with rubber roofing. The entrance end was boarded in and double-walled. The dirt walls were reinforced by boarding up. A small stove was used for heating. One ventilator in the entrance end and one roof ventilator took care of this feature. This type of storage house or cellar can be cheaply constructed, and proved to be successful in this instance. When located on the south, or protected side of a slope, it can be easily heated.

By observance of the principles of insulation and ventilation, old farm buildings may be reconstructed for storage houses at small expense. If possible, they should be used before erecting new storage houses. If the inside walls are not already sheathed, cover the studding with a good grade of building paper, and over the paper a tight layer of matched boards. This insulation should be carried up to the entire ceiling also. Make the house as tight as possible, so that when necessary the temperature can be controlled easily. For a small

house, for example, twelve feet wide by sixteen feet long, a twelve by twelve inch ventilator through the floor at each corner should be fixed so that they can be closed when necessary, and two ventilators of the same size through the roof at the ridge will take care of the roof ventilation. Any windows should be fixed so they can be closed tightly from the outside.

The details and specifications for construction of a modern storage house can not be given here; working plans for building the various size houses may be had upon application to the Department of Agricultural Engineering, A. & M. College, Agricultural College, Miss., or to the Bureau of Public Roads and Rural Engineering, U. S. Department of Agriculture, Washington, D. C. Farmers' Bulletin No. 970, of the U. S. Department of Agriculture, on "Sweet Potato Storage," can also be obtained by anyone wishing to construct a modern storage house, and to learn the full details of the curing process.

Marketing.

In an address prepared for the 1921 meeting of the State Horticultural Society, Mr. James H. Beattie, Horticulturist, Bureau of Plant Industry, U. S. Department of Agriculture, made the following excellent recommendations on marketing the Southern sweet potato:

> "It is useless to grow a fine crop of sweet potatoes, unless they can be profitably marketed. Many cases recently called to the writer's attention show that growers often find it impossible to ship sweet potatoes to Northern markets and realize the packing and shipping costs on them. I do not mean to imply that this is always the case, but it would seem that this phase of the problem is one that must have careful consideration. One source of difficulty has been due to the inclination of many growers to ship ungraded stock that has been badly handled and which suffers great loss in transit. It would seem that the logical thing to do would be to, first, grow only the best varieties and ones which are well known to the trade. Secondly, grade the stock carefully and ship only the best. Third, employ a type of package that will carry the potatoes in good condition and which will exhibit them to good advantage. Fourth, place the potatoes in storage so that they can be marketed throughout the season, and not forced on to the markets at digging time. Fifth, through cooperative growers and storage associations establish a standard product which will command a premium upon the market. Sixth, by the establishment of a suitable selling agency."

The third point referring to the type of package to use should be given especial attention by the shipper. Burlap sacks should never be used, since bad bruising and consequent decay will result. The bushel hamper, bushel basket, and bushel box crate, are now extensively used for shipping. When the hamper and basket are substantially built, they make excellent shipping containers. The bushel basket is gaining in favor in some sections of the South. It is a favorite container for the retailer to handle, and can be packed for an attractive display of the product. All these three shipping packages can be given attractive packs, and selection of any one of them for exclusive use by a sweet potato shippers' association will help much towards establishing and maintaining demand for a well graded product.

The fifth recommendation by Beattie is generally accepted in principle, and growers are beginning to develop cooperative associations in order to put the potato industry on a business-like foundation. A growers' organization is needed in order to establish a uniform, standard product on the market. It should center its efforts on one good variety, aim to produce a uniform, high quality product, and give it attractive package for market. Such a product will get a premium on an over-supplied market of inferior stock. A strong association of growers is necessary to develop such a product, and last but not least, an organization of this kind is necessary to maintain an efficient selling agency.

This last point is but little understood by the average producer. Recent investigations have been made by expert advertising and merchandising organizations to determine how much money would be necessary to properly sell good sweet potatoes. They find that six hundred thousand dollars would be needed for advertising alone, to sell the six million bushels of cured stock now in the South. This expenditure would be small for each grower in a South-wide organization, but it is a necessary expense before the Southern sweet potato is widely demanded on the Northern markets.

Diseases and Insects of the Sweet Potato.

Only brief descriptions and control methods can be given here; Bulletin No. 190, "Diseases of the Sweet Potato in Mississippi and Their Control," gives a detailed account of the diseases, and this bulletin should be in the possession of every sweet potato grower in the State. The remarks following on diseases are derived from that Bulletin.

Diseases.—"Sweet potato diseases may be divided into two classes,—(1) field diseases attacking roots, stems, and leaves, and (2) storage rots. Both groups are important and many of each occur in Mississippi.

FIELD DISEASES.

"Black Rot.—The most serious disease of the sweet potato in Mississippi. It may occur on any of the underground portions of the plant. On the sprouts, it usually begins at the base just beneath the soil line. Here the disease manifests itself as small spots varying from dark-brown to a lamp-black color. These gradually enlarge, extend up the stem, and it is here that we get the stage known as 'black-shank.' In many cases the plants in the seed bed and the field are often rotted off at the base by the shank stage of the fungus. On the roots, it produces circular, dark to olive-brown colored spots, which may cover more than one-third of the surface of the potato. Sweet potatoes infected with black rot are very bitter in taste, and this feature alone is very helpful, indeed, when one is in doubt as to its presence.

"Control.—Careful seed selection in order to insure healthy stock is of primary importance in controlling such diseases as black rot. If black-rotted potatoes are bedded, the sprouts produced therefrom will almost invariably have black-rot, or black-shank, as this stage of the disease is sometimes called. Such practice not only serves as a source of infection to the new crop, but the soil is rendered unfit for the growing of sweet potatoes,

since the fungus is able to live over in the field on diseased potatoes and vines. Before preparing the beds in the spring, the sweet potato seed-stock should be carefully selected, taking care to discard all potatoes having the slightest trace of black-rot or any suspicious spots. All discarded potatoes should be destroyed in some manner, and in no case should they be thrown indiscriminately around the beds. These may be boiled and then fed to stock or else buried in some remote place."

The method of seed treatment to destroy surface germs of this disease has been given under "Bedding."

STEM ROT OR WILT.—This is another field and seed-bed disease, but does not spread in storage like black rot. This disease is becoming established in many sections of the State, though it is not near so widespread yet as black-rot. Stem rot is often responsible for a loss of 50 per cent. in yield. Plants infected with this disease show a decided yellowing along the veins of the leaves, the young leaves showing the trouble first, afterwards the whole vine, giving the plant a dull, pale-yellow appearance. Wilting follows rapidly, especially during a dry season, and the plant soon dies. During wet weather, the infected plants appear stunted but are able to live for long periods before dying entirely out. By splitting the stem of a plant infected with stem-rot, near the base of the hill, it will be found to be streaked with black inside. Control measures of seed selection, etc., as have been given for black rot, serve as preventive to this disease also. Seed disinfection is of no value, however, as the disease is inside the potato.

SCURF, or soil stain, is another very common trouble of the sweet potato. It causes brownish spots scattered over the surface of the potato, lowering its attractiveness on the market, though not causing rot. Neither is the potato spoiled for eating. The disease is worse on low, poorly drained lands, and on soils heavily manured. Field and seed bed sanitation as discussed under "Seed Selection" are important preventives of this trouble, and seed should be treated with corrosive sublimate as recommended for black-rot.

Leaf diseases have been observed here at the Experiment Station, especially white-rust. Leaf-blight and leaf-spot are two other leaf troubles, but at this time none of the foliage diseases have caused much damage.

Foot-rot, sclerotial rot, Texas root-rot, and soil-rot are other field diseases of sweet potatoes that are of less importance to sweet potato growers in Mississippi.

STORAGE ROTS.

SOFT-ROT.—The most widespread and destructive of the storage rots. It produces a soft decay of the potatoes, and destroys the potato in a few days when there is a high temperature coupled with moist air. It often forms a thick, moldy growth on the surface of the potato. Soft-rotted potatoes soon lose their moisture and become hard and brittle, in which stage grower's name it "dry-rot.' Soft-rot gains entrance to the potato through cut or bruised places on the potato. Frosted potatoes always develop soft-rot.

RING-ROT.—Caused by the same mold that produces soft-rot, but the decay begins at a point between the ends, forming a ring, or collar around the potato.

BLACK-ROT, which has already been discussed under Field Diseases, when

present on the potatoes that are taken to storage, will develop under high temperature and humidity, and the disease spread to other healthy potatoes.

Storage rots should be **prevented.** It is next to impossible to control these troubles where the potatoes have already been placed in storage. Observe all the precautions given under careful harvesting of the crop, disinfecting of the seed at bedding time, sanitation of the seed-bed, crop rotation combined with a systematic method of seed selection. Storing potatoes in bins, in bulk, will invite disaster when rots get under way in the house; storing in crates, bushel baskets, or hampers is much to be preferred. If the potato house has been used for storing potatoes before, it should be thoroughly disinfected before storing the new crop. After the house has been swept out clean, it should be sprayed thoroughly inside with a solution of five pounds of bluestone to fifty gallons of water. After twenty-four hours, repeat this spray with the same solution.

Insect Pests.

In this State, the sweet potato has only one serious insect pest,—the sweet potato weevil. At present, this pest has been restricted to a few localities in four counties in South Mississippi, and vigorous efforts are being made to exterminate the pest by the State Plant Board, and United States Bureau of Entomology.

Products of the Sweet Potato.

A large number of products have been derived from the sweet potato, and there is certainly a great future to this crop from the standpoint of its wide and varied products. The following products and by-products should be named: sweet potato syrup; dehydrated potato chips; breakfast flakes; chocolate substitute, available for coating cakes, candies, and making ice cream; flour; starch, dextrine, syrup, caramel candy; tapioca; rubber substitute; dyes ranging from light yellow through brown into black; roofing paint; dehydrated syrup as a confection; vinegar; sour wine; malt health foods; alcohol.

Bulletin No. 207 April 1922

Nitrogenous Fertilizer Experiments

Delta Branch Station

By

C. B. Walker, E. C. Ewing and Ide P. Trotter

Mississippi Agricultural Experiment Station

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D. MAXWELL .....Foreman, Horse and Beef Barns
H. B. BROWN, Weilenman...Collaborator
E. C. EWING, Scott, Miss.....Collaborator

*In Cooperation Bureau of Animal Industry, U. S. Department of Agriculture

DELTA EXPERIMENT STATION

PART I

Nitrogenous Fertilizer Experiments With Cotton For 1921

By G. B. WALKER and IDE P. TROTTER

The fertilizer experiments this year were placed on ground which had never previously been fertilized. The soil is a medium sandy loam and as a whole has more fertility than the average loam soil of this section, which prevents the most marked results being secured from fertilizer applications the first year. However, the soil is about as uniform as can be secured, and considering the triple applications made there need be no allowance made for soil variation in the results reported. The soil conditions average about equal for all tests.

We have run three types of fertilizer experiments this year, nitrogen being the element supplied in each case. Cotton was the test crop. The three tests run were first; a comparison of the different sources of nitrogen; second, a comparison of the different rates of application of nitrogen in the form of nitrate of soda, and third, a comparison of the different dates of applying nitrate of soda.

In calculating the cost of fertilization no charge is made for labor, only the actual cost of the fertilizer is figured. Owing to the fact that some of the fertilizers used are not as yet on the commercial market, and have no recognized market value we have based the charge for the nitrogenous fertilizers upon the number of pounds of nitrogen they carry, using the cost of one pound of nitrogen in nitrate of soda as a basis. Cotton seed meal, however, being comparatively low in nitrogen content, is charged at $30.00 per ton. These facts must be kept clearly in mind when studying the results secured.

Season.—The weather of the early spring was such as to lead many planters to try extremely early planting of cotton, the vast majority of which was lost. But cotton planted from the middle to the last of April got sufficient rain to get its growth well started ahead of the dry spell. Its progress then was never seriously checked. The season then was very good on cotton planted when these plats were, April 30.

The first indications of boll weevil infestation on the Station this year were noticed in a field located just north of the west end of the plats of this experiment. A little later they were noticed in a field to the east of the east end of the experiment, where later they became very numerous. No effort to control the weevil, other than frequent and thorough cultivation was attempted this season, so that we are justified in concluding that the weevil damage, though severe, was about as uniform as could be expected in fild work.

Results.—In the test of various sources of nitrogen, five different sources were tested and one combination source, viz: Nitrate of Soda, Ammonium Nitrate, Ammonium Sulphate, Cyanamid, Cotton Seed Meal and a combination of Cotton Seed Meal and Nitrate of Soda. Table I shows the results of the test. The seventh column shows the gain in pounds of seed cotton per acre, which is due to the fertilizer applied, viz: The amount made by the fertilized plats more than was made by the adjacent unfertilized plats. It might be noted here that the unfertilized plats in this test averaged 1460 pounds of seed cotton per acre. A strain of Express cotton was grown on these plats which we calculate turned out 30 per cent at the gin, the lint bringing 30c per pound when sold, and the seed $30.00 per ton. Table I then shows that Ammonium Sulphate applied at the rate of 75 pounds per acre gave the best money profit, yielding $25.34 per acre net. An application of 100 pounds of Nitrate of Soda comes close behind it with a profit of $24.53. Ammonium Nitrate, applied 50 pounds per acre, followed with a profit of $20.82. These three proved the most efficient of the nitrogen carriers tested. Cotton Seed Meal, applied 250 pounds per acre, produced six pounds more seed cotton than 125 pounds of Cotton Seed Meal and 50 pounds of Nitrate of Soda. When the cost of the fertilizer is deducted, however, the combination leads by a scant two cents, showing $14.06 against $14.04 for the Cotton Seed Meal alone, a difference too small to be of any practical value. The cost of making the two applications would perhaps give the advantage to the single application of Cotton Seed Meal. Cyanamid applied at the rate of 100 pounds per acre showed the only negative result of the whole test under cotton, showing a loss of 29 cents per acre. So we see Ammonium Sulphate, Nitrate of Soda and Ammonium Nitrate in the order named, proved profitable sources of nitrogen under cotton when they can be secured at about equal cost per pound of nitrogen. While some of the others make money they could hardly be termed profitable when these others can be secured which show so much greater profit.

TABLE No. I—Showing the Results of a Test of Various Nitrogenous Fertilizers Under Cotton, 1921.

SOURCES	YIELD OF SEED COTTON PER PLAT SERIES A	B	C	Total	Lbs. Av. per Acre.	Est. Yield Without Fertilizer.	Gain Due to Fertilizer. Lbs. Seed Cotton.	Money Value of Gain.	Cost of Application.	Profit or Loss.	Rank in Profit or Loss.
Check	41.3	51.3	35.9	128.5	1428	1428					
Nitrate of Soda, 100 lbs.	50.0	61.2	41.7	152.9	1699	1432	267	$26.83	$2.50	$24.33	2
Ammonium Nitrate, 50 lbs.	51.2	59.0	39.9	150.1	1668	1435	232	23.32	2.50	20.82	3
Ammonium Sulphate, 75 lbs.	49.8	56.3	48.4	154.5	1717	1440	277	27.84	2.50	25.34	1
Check	46.5	48.9	34.6	130.0	1444	1444					
Cyanamid, 100 lbs.	46.2	48.5	38.7	133.4	1482	1460	22	2.21	2.50	0.29	6
Cotton Seed Meal, 250 lbs.	49.7	54.8	44.3	148.8	1653	1476	177	17.79	3.75	14.04	5
C. S. Meal, 125 lbs., Nitrate, 50 lbs.	49.7	55.2	44.8	149.7	1663	1492	171	17.19	3.13	14.06	4
Check	51.3	50.6	33.7	135.6	1507	1507					

Value of Lint 30c per lb. Seed $30.00 per ton.

Rate of Applying Nitrate of Soda.—In this we tested applications of Nitrate of Soda in varying amounts from 50 pounds per acre to 300 pounds per acre, increasing by 50 pounds each time. Table II shows at a glance

TABLE NO. II.

Showing the Results of a Test of Various Rates of Application of Nitrate of Soda to Cotton, 1921.

RATE	YIELD OF SEED COTTON PER PLAT SERIES A	B	C	Total	Lbs. Av. per Acre.	Est. Yield Without Fertilizer.	Gain due to Fertilizer Lbs. Seed Cotton.	Money Value of Gain.	Cost of Application	Profit.	Rank in Profit.
Check	50.6	45.6	35 6	131.8	1464	1464					
50 lbs.	48.4	47.4	40.2	136.0	1511	1456	55	$5.53	$1.25	$4.28	6
100 lbs. ...	53.4	50.4	38.2	142.0	1578	1448	130	13.07	2.50	10.57	5
150 lbs. ...	53.5	54.4	43.0	150.9	1677	1440	237	23.82	3.75	20.07	4
Check	45.5	37.6	36.7	119.8	1331	1331					
200 lbs. ...	55.0	51.4	43.5	149.9	1666	1337	329	33.06	5.00	28.06	2
250 lbs. ...	59.6	54.0	44.0	157.6	1751	1344	407	40.90	6.25	34.65	1
300 lbs. ...	58.9	54.9	36.0	149.8	1664	1351	313	31.46	7.50	23.96	3
Check	45.6	35.6	40.9	122.1	1357	1357					

Value of Lint 30c per lb. Seed $30.00 per ton.

that during this season the heavier applications proved very much the most profitable. In an average season the profit from the larger applications has not been nearly so marked, due perhaps to the fact that there is an abundance of moisture present to make the smaller applications totally unavailable and thus supply the needs of the plants. In a dry season such as this, however, there is not enough moisture to render the fertilizers totally available, so that the larger applications were necessary to supply enough available nitrogen to meet the needs of the crop.

The 250-pound application, with a net profit of $34.65, led by a good margin. Two hundred pounds per acre came second with $28.06, followed by 300 pounds, with a profit of $23.96. The remaining three applications show decreasing profit as the amount of Nitrate of Soda decreases. The 150-pound application with $20.07 profit, being the only one near enough to compare with the three leaders.

Date of Applying Nitrate of Soda.—The standard application in this test was 100 pounds of Nitrate of Soda per acre. In four cases it was all applied at once and in the other two cases the applications were divided. Fifty pounds at planting time and 50 pounds at first squares shows the greatest profit, returning $18.91 net per acre as shown by Table III. One hundred

TABLE NO. III.

Showing Results of a Test of Various Dates of Applying Nitrate of Soda to Cotton, 1921.

Date of Applying.	YIELD OF SEED COTTON PER PLAT				Lbs. Av. per Acre.	Est. Yield without Fertilizer.	Gain Due to Fertilizer, Lbs. Seed Cotton.	Money Value of Gain.	Cost of Application.	Profit or Loss.	Rank in Profit
	SERIES										
	A	B	C	Total							
Check	54.9	45.7	47.0	147.6	1640	1640					
100 lbs. Planting	58.8	45.0	45.8	149.6	1662	1597	65	$6.53	$2.50	$4.03	5
100 lbs. First Dirting	58.6	45.2	45.7	149.5	1661	1554	107	10.75	2.50	8.25	4
100 lbs. First Squares	55.5	46.3	44.6	146.4	1627	1510	117	11.76	2.50	9.26	3
Check	47.4	44.6	40.0	132.0	1467	1467					
100 lbs. First Blooms	53.3	48.4	45.8	147.5	1639	1457	182	18.29	2.50	15.79	2
50 lbs. Planting & 50 lbs. First Squares	51.5	54.6	43.4	149.5	1661	1448	213	21.41	2.50	18.91	1
50 lbs. Planting & 50 lbs. First Blooms	46.2	40.0	38.7	133.9	1488	1438	50	5.03	2.50	2.53	6
Check	45.7	47.0	35.9	128.6	1429	1429					

Value of Lint 30c per lb. Seed $30.00 per ton.

pounds at first blooms came second, with 100 pounds at first squares a poo third. The least profitable proved to be 50 pounds at planting and 5(pounds at first blooms, giving only $2.53 net profit per acre. Why this pla should have dropped so far below the others of so nearly the same treatmen is hard to explain. But these results would seem to indicate that the medium late side applications are advantageous.

Summary.—The results under cotton are uniformly profitable, with the single exception of Cyanamid. This shows that almost any form of nitrate will give profitable returns under cotton, as will also Nitrate of Soda ap plied in varying amounts and at various times. This can be shown impres sively by adding up the expense for fertilizer in this set of experiments which gives us $58.13 as the total cost of the fertilizer used. Now, adding up the profit or loss columns we find a total profit of $278.95, with a single loss of 29 cents. So, deducting this loss we have a net profit of $278.66 from an investment of $58.13, no charge being made in these figures for whatever additional labor may have been necessary. If then $58.13 worth of fertilizers, applied to the crop in such heterogenous forms and fashions as was true with this test, should return between four and five times as much money in increased crops, should we not reasonably expect a much larger return from investments in fertilizers, all of which were applied in the manner which showed most profit in this test? Should not a return of five times the investment be sufficient to induce anyone to fertilize?

The most striking of the cotton results were those in the Rate of Appli cation of Nitrate of Soda test. Here we secured the most profitable returns on the poorest piece of ground in the test, the check, or unfertilized plats averaging only 1,384 pounds of seed cotton per acre. Every increase of 5(pounds of Nitrate of Soda produced a good increase in profit up to and including the 250-pound application. With the 300-pound application, how ever, we note a falling away from this rule. The increases in profit were proportionately greater for the first two increased applications than for the later ones. An explanation of this was offered earlier in this bulletin.

The comparison of the various sources of nitrates was the next most interesting work. Seventy-five pounds of Ammonium Sulphate led all the sources under cotton, and Nitrate of Soda ranked second.

The Date of Application Results are fairly consistent and would indicate that side applications as late as first blooms are profitable. But the char acter of the results of all these tests makes it advisable to have results over a longer period of time before making any definite general conclusions.

PART II.

Fertilizer Experiments---1920

The fertilizer work done in 1920 was very unsatisfactory in several ways. First, there was no duplication of the work. So every treatment had only one trial and then there was no way to equalize soil variation, and other such variables, through several similar plats. Again, the soil on which the tests were run was not as uniform in character or fertility as would be desirable for accurate experimental work. Thus we see that no great dependence can be placed in the figures for this year's work when considered alone. However, they may be of value when considered in connection with the figures of other years' work of this character. It is with this idea in view that we publish this year's results and the comments on them, and so we take special care to advise against too great dependence in these figures when unsupported by others. Cotton was the only crop used in this work and it was planted on May 11..

The first six plats composed the test of various sources of nitrogen with the results reported in the first part of Table IV. Ammonium Sulphate was the leader and Ammonium Nitrate came second, followed by Nitrate of Soda. Cyanamid was last. This is in line with the 1921 results with the exception that Ammonium Nitrate followed Nitrate of Soda that year instead of leading it.

In the tests of varying quantities of these fertilizers some very erratic results were secured and in most cases we have no figures to compare with them. Plats 7 to 10 of Table IV were treated with from 66 to 264 pounds of Nitrate of Soda per acre each. The smallest application, or 66 pounds, led all the others by a good margin.

The 198- and 264-pound applications followed in the order named, but over 100 pounds behind the 66-pound plat. Why the 125-pound application fell off so heavily we are unable to account for. Taking the figures of the test as a whole, however, they tend to bear out the old contention that the heavier applications of Nitrate of Soda are not profitable. But the results are too erratic for dependability.

In plats 12 to 15 with applications of Sulphate of Ammonia ranging from 50 to 200 pounds per acre, the 100-pound plat leads, followed closely by the 150-pound plat. The 200-pound plat falls off sharply, dropping materially below the plat to which only 50 pounds was applied, again indicating the futility of the heavy applications.

Cyanamid, however, failed to follow this rule, the greatest increase coming from the heaviest application and the poorest increase from the lightest application. The intermediate applications did not follow this rule.

TABLE IV.

Showing Results of Tests of Various Sources and Applications of Nitrogenous Fertilizers to Cotton, 1920.

Plot No.	Treatment.	Seed Cotton per Acre.	Est. Yield No Fertilizer.	Gain Due to Fertilizer.	Rank in Increased Yield Due to Fertilizer.
1	Untreated	933		64	3
2	133 lbs. Nitrate of Soda	1000	936	64	3
3	100 lbs. Sulphate of Ammonium	1100	940	160	1
4	100 lbs. Cyanamid	965	943	22	4
5	66 lbs. Ammonium Nitrate	1100	947	153	2
6	Untreated	950			
7	66 lbs. Nitrate of Soda	1200	937	263	1
8	125 lbs. Nitrate of Soda	1010	924	86	4
9	198 lbs. Nitrate of Soda	1066	911	155	2
10	264 lbs. Nitrate of Soda	1050	898	152	3
11	Untreated	855			
12	50 lbs. Sulphate of Ammonia	1040	908	132	3
13	100 lbs. Sulphate of Ammonia	1133	931	202	1
14	150 lbs. Sulphate of Ammonia	1144	954	190	2
15	200 lbs. Sulphate of Ammonia	1066	977	89	4
16	Untreated	1000			
17	50 lbs. Cyanamid	1100	987	113	4
18	100 lbs. Cyanamid	1120	973	147	2
19	150 lbs. Cyanamid	1086	960	126	3
20	200 lbs. Cyanamid	1180	946	234	1
21	Untreated	933			
22	33 lbs. Ammonium Nitrate	1180	946	234	1
23	66 lbs. Ammonium Nitrate	1040	960	80	4
24	100 lbs. Ammonium Nitrate	1093	973	120	3
25	125 lbs. Ammonium Nitrate	1144	987	157	2
26	Untreated	1000			
27	Untreated	1000			
28	100 lbs. Nitrate applied first dirting, 6/11	1366	998	368	3
29	100 lbs. Nitrate applied before planting	1413	995	418	2
30	50 lbs. Nitrate applied before planting and 50 lbs. Nitrate applied first dirting	1460	993	467	1
31	50 lbs. Nitrate applied before planting and 50 lbs. Nitrate applied first squares	1326	990	336	4
32	50 lbs. Nitrate applied before planting and 50 lbs. Nitrate applied first blooms	1200	988	212	5
33	Untreated	986			

But in spite of some fairly good results in this particular test Cyanamid has never proved a profitable fertilizer here.

A peculiar comparative result will be noted between plats 20 and 22. These two plats, the first receiving 200 pounds of Cyanamid and the other 33 pounds of Ammonium Nitrate and being separated by only one untreated plat. yielded the same increase attributable to the fertilizer applied. However, with the remaining Ammonium Nitrate applications the heavier applications gave the best results. The fact that 33 pounds of Ammonium Nitrate gave 334 pounds increase while the adjoining plat with 66 pounds of Ammonium Nitrate gave only 80 pounds increase, only goes to prove that this test is too inconclusive to rely upon when considered alone.

The test of time of application showed a good increase for every application with the 50 pounds at planting and 50 pounds at first dirting easily the leader. One hundred pounds before planting came second, while 100 pounds at first dirting was third. The application of 50 pounds at planting time and 50 pounds at first squares ranked fourth in this test, but was the leader in the 1921 test, thus giving stronger evidence for the split applications.

General Summary.—From a study of all the work reported in this bulletin, which covers a variety of work in different places and under different soil and seasonal conditions, we find that there is abundant proof that even liberal applications of nitrate to cotton lands, both poor and of good quality, will pay for themselves many times over. We find also that there are several carriers of nitrogen which are just as efficient if not more efficient than Nitrate of Soda, which is recognized as the standard nitrogen carrier at present. Up to the present time the value of nitrogenous fertilizers has been largely determined by the cost of an equal amount of nitrogen in Nitrate of Soda, as the supply of these other fertilizers is too limited to control the price. However, there is now hope that with the developing of the water power resources of the country and the availability of great electrical power at low cost, we may have these other nitrogenous fertilizers manufactured in these hydro-electric plants at a much lower cost than now obtains. Such a hope is particularly bright in regard to the possible completion of the Muscle Shoals power plant. One of the principal fertilizers which this plant will manufacture will be Ammonium Nitrate, which has given a very good account of itself in the tests reported in this bulletin. If large scale production of this fertilizer could be realized at Muscle Shoals or elsewhere, the time may not be far distant when by the use of cheap nitrogenous fertilizers the productive power of our land may be materially enhanced and the farmer may secure from a smaller cultivated acreage a much larger crop yield. Then will open a new day for the farmers, particularly of the Mississippi Delta, where nitrogen is the only essential plant food element which is deficient.

PART III

Tests With Nitrate of Soda For Cotton and Corn at Scott, Mississippi.

By E. C. EWING

Collaborator Mississippi Experiment Station

Experimental Department, Delta and Pine Land Company of Mississippi

Introduction

Investigations at the Delta Experiment Station during the past fifteen years, as well as trials elsewhere, have indicated that nitrogen is the only essential plant food element which has become deficient in the soils of the Mississippi Delta, and that the use of commercial nitrogenous fertilizers is often profitable practice. The following is an account of certain experiments which have been made, under plantation conditions, on the estate of the Delta and Pine Land Company of Mississippi, in Bolivar County, to determine what gains in the crop are to be expected from the use of nitrate of soda. This record is submitted for publication with the hope that it will be of interest and benefit to other Delta planters.

While we have used the technique of experiment stations and taken every reasonable precaution to obtain as high a degree of accuracy as possible, the cultivation of our plats has not been better than good cultivation as practiced on a well worked plantation. We believe, therefore, that our results are applicable generally to plantation conditions where average to good farming is done.

Nitrate of Soda On Cotton

Plan of Experiments.—In all our tests the nitrate of soda has been used on cotton as side application.

In laying out these experiments the plan has been to use a number of test plats lying side by side for the different fertilizer treatments, the same treatment being repeated several times on similar plats. Each treatment was used from three to six times on these parallel plats. In 1916 when these experiments were begun, we had only three plats representing each fertilizer treatment. The plan finally adopted in later tests has been to use

six replicate series of three plats to the series, the three classes of plats being treated as follows:

Check plats, receiving no fertilizer.

100 pounds of nitrate of soda per acre.

150 pounds of nitrate of soda per acre.

Accordingly, plat No. 1 is a check plat; No. 2 gets 100 pounds of nitrate of soda per acre; No. 3, 150 pounds of nitrate of soda per acre; then the same order of treatment is repeated five times, No. 4 being a check plat, and so on. In addition to the six plats of each class, an additional check plat, No. 19, is added at the end.

The two general classes of Delta soil, loam and buckshot, have been represented in our tests.

Short staple cotton has been planted in all but the 1916 test. With that exception, Wannamaker Cleveland has been the variety grown.

Time of Application.—In the later experiments the effort has been made to distribute the fertilizer as soon as possible after the cotton was chopped out. The date of application has varied in our tests from May 31 in the case of test No. 4 to June 23 and 24 in test No. 5, the average date of application being June 14. Since moisture is necessary to dissolve the salt and make it available after it reaches the soil, the date on which the nitrate is put down is not so important as the date of the first soaking rain thereafter. The average date of such a rain has been June 20, and this may, therefore, be considered the average effective date of application of the fertilizer.

Tests made at the Alabama Station* indicate that on an average the most effective time of application is at the time of chopping and dirting up, and that practice is to be recommended, in our opinion, on loam soils in the Delta. It is important to get the nitrate on the land early enough to insure its being made available by rains early in the growing season, and as soon as the cotton can be cleaned out, the nitrate should be applied.

On buckshot land, which is generally freer from grasses than the loam land, it would seem that there can be no objection to putting out nitrate of soda at planting time. Apparently little is leached out during the season and, since cotton so often fails to grow off well in June on buckshot soil, the very early use of nitrate of soda may be of considerable benefit in starting growth. However, we can never tell until cotton is chopped out what sort of stand we will get. It is not profitable to fertilize a poor stand of cotton, and the possibility of such a condition is to be considered.

Boll Weevil Damage.—The cotton used for these fertilizer tests has been protected more or less from boll weevil damage since 1918. In some cases this has resulted from dusting the plats with calcium arsenate. In other

*Cauthen, E. F. Time of Applying Nitrate of Soda to Cotton, Ala. Sta. Bul. 209, 1920.

cases the plats in question were not dusted but other cuts badly infested on the plantations were dusted and this, by delaying the infestation benefited the test plats indirectly. In no case have the fertilizer plats had one hundred per cent protection, though in some cases damage has been almost entirely prevented.

Loam and Buckshot Soils Both Represented.—These tests have been conducted on a productive type of silt loam soil, lying near Lake Bolivar and Deer Creek. It is typical of the better class of "front lands" common along the streams throughout the Delta, which have long been in cultivation. With the exception of the 1917 test, all of these trials on loam land have been conducted in a field used exclusively for experimental purposes. The 1917 test was located in an adjoining field worked by a negro tenant.

As the experimental field at Scott contains no buckshot soil, it has been necessary to use cotton growing elsewhere on the plantations for making the tests on buckshot soil. For this purpose plats have been staked off in tenants' crops. The nitrate was applied in the same way, however, and the same plan of arrangement and replication of plats that was followed in the experimental field was used in these plantation tests. Otherwise the cotton was cultivated by the tenant in the ordinary way. In choosing the crops for these tests, however, care has been taken to locate where they would be well cultivated and on land that was as uniform in soil fertility, soil type, drainage, and the stand of cotton as possible, in order to secure uniformity in our results.

It has not been possible to conduct these plantation tests with quite the same precision as has been attained in tests conducted in the experimental field. This is shown by the fact that the probable errors of the results from buckshot soil are higher than the probable errors of the results from loam soil. Nevertheless, the fact that these tests were made under actual normal plantation conditions gives a good indication of the possibilities of the fertilizer under those conditions.

Discussion of Results.—In table I below are compiled the results of the several fertilizer tests which have been carried through on similar lines at Scott. During the five years from 1917 to 1921 we have completed seven of these tests, four on loam and three on buckshot soil, to determine the effect of 100 pounds of nitrate of soda and 150 pounds of nitrate of soda. The plats so fertilized have been compared with identical plats receiving no fertilizer. In the table are shown the principal results of each test, viz., in the third column the mean or average yield per acre of the unfertilized check plats with the probable error of this mean. For example, in the first test this is 1575 pounds of seed cotton per acre plus or minus 20 pounds, the latter figure being the probable error of the former. In the second column is shown the mean percentage gain from the use of 100 pounds of nitrate of soda. In test one this increase is 10.8 plus or minus 4.0 per cent. In the

third column is shown the percentage gain from 150 pounds of nitrate p acre, viz., as in test 1, 15.6 plus or minus 1.1 per cent.

The probable error is computed for each figure to show its degree accuracy. or rather the degree of confidence to be placed in the results. all experimental work a certain amount of experimental error is necessari involved. This is illustrated by the fact, so familiar to investigators, th it is almost impossible to obtain exactly the same result twice in successi by repeating any field experiment. In spite of precaution to select for exp imental purposes the most uniform land to be had, natural soil differenc in the several plats especially affect their production. This illustrates o of the causes of variation in experimental results, one of the sources of e perimental error.

The probable error is computed by a standard formula. Its magnitu depends both on the variation in yield between the several plats averag and on the number of plats. Therefore, the best way to reduce the probab error and increase the precision of our results is to provide as uniform s and other experimental conditions as possible and to repeat the number trials as many times as possible. or in other words, to employ as many pla as practicable to represent each treatment.

If there were no uncontrollable sources of error, the yield found for a particular treatment could be accepted with absolute confidence. but r such conditions are possible. Consequently there is necessarily a degree uncertainty about the application of our results. and the probable error provided to serve as a measure of the confidence to be placed in them. is implied in this case that it is an even chance that the true yield li within the limits set by the probable error. In test one, for example, w are justified in assuming that the chances are even that the correct yie of the check plats lies somewhere between 1555 and 1595.

Likewise we may say that the data from test 4, for example. indicat an even chance that the following results may be expected, namely. that th increased yield produced by 100 pounds of nitrate should be between 13 per cent and 20.5 per cent, or 16.9 ± 3.6 per cent, and that 150 pounds shoul increase the crop somewhere from 19.1 per cent to 26.1 per cent. Thi roughly, is the significance of the probable error as used here.

Combining the results of all tests, we find that the average yield ob tained without fertilizer has been 1300 pounds of seed cotton per acr Where 100 pounds of nitrate of soda per acre has been used, the averag increase was 15.0 per cent, or 195 pounds of seed cotton per acre. Th average increase from 150 pounds of nitrate per acre has been 20.6 per cen or 268 pounds of seed cotton..

TABLE 1.

Cotton Fertilizer Tests, 1917 to 1921, Seed Cotton.

Test	Year	No Fertilizer Yield Seed Cotton per Acre	Increase 100 lbs.	Increase 150 lbs.
		LOAM SOIL.		
1	1917	1575±20 lbs.	10.8±4.0 per cent	15.6±1.1 per cent
2	1918	1421±21 lbs.	14.2±1.7 per cent	15.5±2.0 per cent
3	1920	918±17 lbs.	12.7±2.1 per cent	25.9±2.8 per cent
4	1921	1418±31 lbs.	16.9±3.6 per cent	22.6±3.5 per cent
Averages Loam		1333 lbs.	13.6 per cent	19.9 per cent
		BUCKSHOT SOIL.		
5	1919	1976±90 lbs.	17.7±6.2 per cent	22.9±5.7 per cent
6	1920	1096±21 lbs.	16.6±2.4 per cent	20.8±3.6 per cent
7	1921	713±30 lbs.	16.0±5.2 per cent	20.6±5.6 per cent
Averages Buckshot		1253 lbs.	16.8 per cent	21.4 per cent
Gen. Averages		1300 lbs.	15.0 per cent	20.6 per cent

We have found that the use of nitrate of soda slightly lowers the lint percentage, or gin turn out.

The plats having no fertilizer have shown a higher lint percentage than the fertilized plats in all cases where we have made ginning tests on the cotton produced. There has not been much difference, however, between the effect of 100 pounds and the effect of 150 pounds of nitrate on the lint percentage.

Unfortunately we have made no ginning tests on the cotton grown on buckshot soil and are obliged to use results obtained from three of the tests on loam soil as the nearest approximation for determining the average lint yields of all tests.

The average lint turnout of the cotton grown without fertilizer has been 34.96 per cent; that grown with 100 pounds of nitrate of soda, 34.57 per cent; and with 150 pounds of nitrate, 34.60 per cent. This difference in lint percentage of only about four-tenths has considerable effect on the lint production. It makes sufficient difference to reduce the gain due to 100 pounds of nitrate from 15.0 per cent as seed cotton down to 13.6 per cent when the comparison is made on a lint basis.

TABLE 2.

Comparison of Yields of Seed Cotton and Lint

	Check Plats.	Plats Receiving 100 lbs. Nitrate per Acre.	Plats Receiving 150 lbs. Nitrate per Acre.
Pct. increase, seed cotton.		15.0%	20.6%
Yield Seed Cotton per acre	1300 lbs.	1495 lbs.	1568 lbs.
Mean lint per cent	34.96%	34.57%	34.60%
Mean yield lint	455 lbs.	517 lbs.	545 lbs.
Increase in yield of lint		62 lbs. or 13.6%	88 lbs. or 19.3%

The increases secured on buckshot soil have been slightly greater than those obtained on loam soil. In all cases, however, the buckshot land used has been rather well drained and has had as favorable a chance to make a full crop as the average loam land. These results prove that the buckshot soil may become as deficient in nitrogen as the loam soil, and that under favorable conditions the use of commercial nitrogen will pay as well on buckshot land as on loam. Still it must be recalled that the black land as a rule is not as well drained as the loam land and that cotton develops slower on buckshot land. For this reason, as well as others, cotton is more subject to severe boll weevil damage on buckshot soil. Of course, with heavy weevil damage most of the effect of the fertilizer will be lost.

1916 Test.—The first fertilizer test in this series of experiments was made in 1916. Here only one rate of application, 125 pounds of nitrate of soda per acre, was tried in comparison with untreated check plats. This rate of application is different from that used in the seven later tests, and a different variety of cotton, Express, was planted that year. For these two reasons, this test is not directly comparable with the subsequent trials. On this account the results are not included in the summary. The detailed results are shown in the following table.

TABLE 3.

Cotton Fertilizer Test 1916, Loam Soil, Express.

	Yield Seed Cotton per acre pounds.	Lint Percentage.	Lint per Acre Pounds.	Seed Percentage.	
Check plats	1090±47	25.36	276±12	73.47	801±30 lbs.
125 lbs. Nitrate	1312±40	24.28	319±10	74.63	979±30 lbs.

Increase from nitrate 222±62 lbs. seed cotton per acre or 20.4±5.7 per cent
Increase from nitrate 42±16 lbs. lint cotton per acre or 15.2±5.8 per cent
Increase from nitrate 178±46 lbs. seed per acre or 22.2±5.7 per cent

Little Gain From Fertilizer Where Cultivation Is Poor.—The results of this test are published merely to show that profitable returns cannot be secured from the use of nitrate of soda on cotton unless the crop is well cultivated. In 1919 the cotton used for the regular test with nitrate of soda on loam soil was very poorly worked. It got in the grass early and was never kept clean after that. In the first place, the nitrate of soda was not put out until July 1, the application having been delayed in the hope that the cotton could first be cleaned of grass. However, it was never got even fairly clean and never got much work until late in the season. The yields from this test are shown in the following table:

TABLE 4.

Cotton Fertilizer Test, Loam Soil, 1919.

	Yields of Seed Cotton per Acre Pounds	Difference in Pounds per Acre.	Percentage Differences.
Check plats	1016±34 lbs.		
100 lbs. Nitrate	1029±21 lbs.	13±40 lbs.	1.3±3.9 per cent
150 lbs. Nitrate	1145±78 lbs.	129±85 lbs.	12.7±8.4 per cent

The plats fertilized at the rate of 100 pounds of nitrate per acre yielded only 1.3±3.9 per cent more than the unfertilized plats. This difference

being less than the probable error has no significance, so there is no indication that any gain whatever was secured. It is apparent that the plats receiving 150 pounds per acre did not do very much better when we consider that the gain of 12.7 per cent is only one-half greater than its probable error.

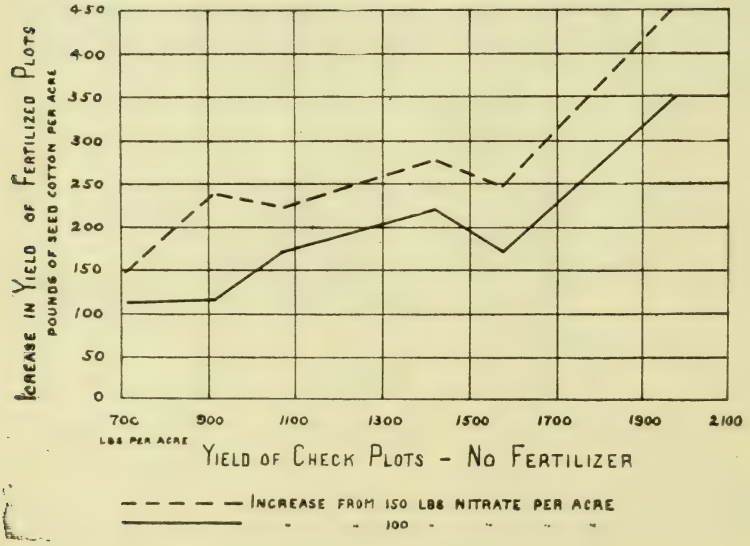
Judging from these figures, one might say that apparently the grass got practically all the value of the 100 pounds of nitrate of soda and that it took as much as 150 pounds of nitrate to produce an apparent gain, which is itself even doubtful. It is clear that in order to be certain of a profit from the use of nitrate of soda on cotton, good cultivation must be given the crop. If it is not reasonably certain that the crop will be well worked, it is best to leave off the fertilizer. The results of this test are published to emphasize that point.

This test is an exceptional case and is not included in the summary, which is intended to show the possibilities of the fertilizer under good farming methods.

Practical Application of Results.—The results of our nitrate of soda tests have followed the general rule that where fertilizer is used on more productive land the increase, when measured in pounds per acre, is greater than

Figure 1,

CURVES SHOWING INCREASED YIELD IN POUNDS OF SEED COTTON FROM PLOTS RECEIVING NITRATE OF SODA - RELATIVE TO YIELD OF CHECK PLOTS

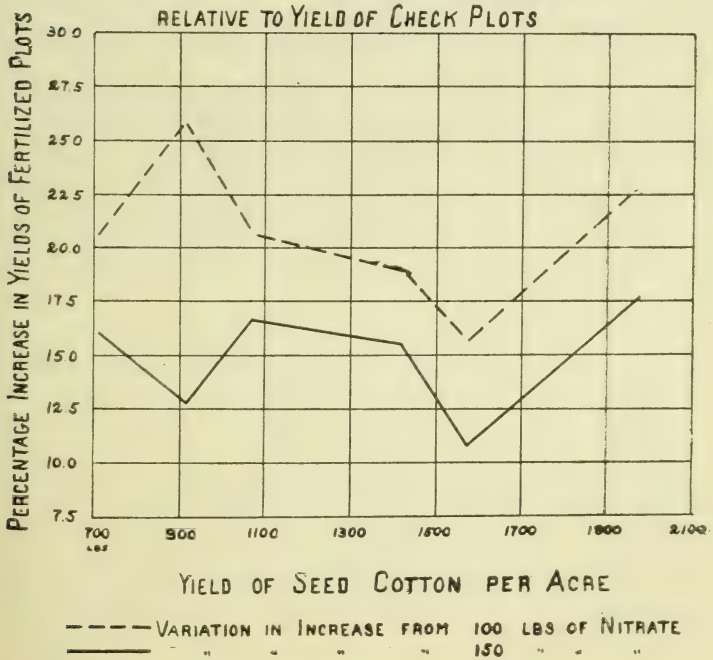


on less productive land. For example, in test 7, where the yield of seed cotton was 713±30 pounds per acre without fertilizer, 100 pounds of nitrate increaced the yield by only 114±37 pounds of seed cotton per acre and 150 pounds of nitrate gave an increase of only 147±40 pounds. In test 5, where the yield was 1976±90 pounds of seed cotton per acre without nitrate, the increases were 350±123 and 452±113 pounds of seed cotton per acre, respectively, from the application of 100 pounds and 150 pounds of nitrate of soda per acre.

This relationship is illustrated graphically in figure 1. In this diagram the yield of seed cotton per acre from the unfertilized cotton in each of our tests is represented on the scale at the bottom of the figure. The two curves show the increase in seed cotton from 100 pounds and 150 pounds of nitrate of soda, respectively, corresponding to different yields obtained without fertilizer in each test.

In only one case, that of test 1 (1917), where the unfertilized check

Figure 2



plats yielded 1575 pounds of seed cotton per acre, do the curves dip dow

In one case we have combined figures from two tests into one for th purpose, so there are only six points instead of seven to each curve. In te 2, where the yield of the check plats was 1421 pounds and in test 4, whe it was 1418 pounds of seed cotton per acre, we have averaged these two fi ures at 1420 pounds, with a corresponding average increase of 221 pound from 100 pounds of nitrate and 270 pounds from 150 pounds of nitrate.

Figure 2 illustrates graphically another aspect of these same result Here the increases produced by the fertilizer are considered as percentag of the yields of the unfertliized check plats in their respective tests.

Figure 2 is a graphic representation of the data in table 1. There i perhaps, a slight though not pronounced downward trend to these tw curves, this tendency being more noticeable in the upper than in the low curve.

It is probable, therefore, that we should expect a slightly higher pe centage increase from nitrate of soda on poor land than on rich land, oth things being equal. However, it is almost certain that a greater actual i crease in pounds and a greater profit from the investment will be made fertilizer is put on the more productive land. This statement is in line wi the generally recognized principle that fertilizers will pay best on good lan

The use of nitrate of soda on new grounds or on lands made excessive rich, of course, is not recommended, but it is very evident that if one has limited amount of money to invest in nitrate of soda, the most profitab returns will be secured by using it on land which can be depended on productive. This, of course, means land of fair natural fertility, land th is well drained and will be well cultivated. The crop must also have a fa chance with the boll weevil, the greater the weevil damage the smaller t fertilizer profit will be.

If these conditions are provided, we consider it safe to count on average increase of about 15 per cent in seed cotton from 100 pounds nitra and about 20 per cent from 150 pounds, or if we figure in terms of lint, t corresponding increases would be 13.6 per cent and 19.3 per cent. If assume a uniform rate of increase, the following table would assist in es mating the probable amount of increase to be expected where a certain yi is obtained without fertilizer. In order to judge whether it will be profital to use nitrate of soda and in what amounts under these conditions, we wo use this table in figuring the cost of the fertilizer against the probable pr of cotton. It may be assumed that the percentage increase will, perhaps, somewhat higher on poorer lands and somewhat lower on richer lands th the table would indicate.

TABLE 5.

Table Showing Increased Yields of Lint to Be Expected from Nitrate of Soda Corresponding to Various Yields Which Would Be Secured

Yield Without Fertilizer Lint per Acre.	Increase from 100 lbs. Nitrate Lint per Acre.	Increase from 150 lbs. Nitrate Lint per Acre.
100 lbs.	13.6 lbs.	19.3 lbs.
200 lbs.	27.2 lbs.	38.6 lbs.
300 lbs.	40.8 lbs.	57.9 lbs
400 lbs.	54.4 lbs.	77.2 lbs.
500 lbs.	68.0 lbs.	96.5 lbs.

The increase in yield of seed is also to be considered as an additional profit. On the other hand, as the yield of lint and seed increase, the cost of picking, ginning and handling the increased yield is to be taken into account in estimating profits.

Nitrate of Soda on Corn.

Nitrate of Soda On Corn.—Table 5 shows a summary of results with nitrate of soda as a top dressing, or side application for corn. All trials have been made with one hundred pounds and one hundred and fifty pounds of nitrate per acre. Only one of these tests, No. 3, 1921, was made in the field of the Experimental Department mentioned in connection with the cotton experiments. The other five were made in connection with some of the regular corn crops of the plantations.

In laying out the plats for the corn work, the same plan which was explained as having been used in the cotton experiments has been followed. All of the corn fields, as well as the test in the experimental field, have been planted in check rows. Equal areas have been staked off in these fields for the several plats and have been handled as replicate parallel series of three plats to the series, just as in the case of the cotton experiments. We have finally adopted the same system of using six plats to represent each treatment, with an extra check plat, or nineteen in all.

The corn has always been planted in March and given average cultivation. The fertilizer has usually been put out when the corn stalks averaged about shoulder high at about June 10. We have not made any investigations with reference to the time of application. We have tried to put the nitrate out in time to get the benefit of sufficient rain to make a large part of the salt available before the corn plants matured. In this we have not always been entirely successful and had more rain occurred after the application of the nitrate we would, no doubt, have secured larger gains. On the other hand, we did not apply the nitrate earlier for fear that the effect of the fertilizer would go into the production of a large stalk at the expense of ear development. In the light of our experience we would rather risk earlier applications as we think the danger from the latter source is more remote than the possibility of poor results due to dry weather. The earlier the nitrate is applied after cultivation is well started, the surer it will be dissolved and ready for the plants when needed.

In the case of March planted corn, we would advise the distribution of nitrate about the 15th to the 20th of May, or when the plants are about knee high.

The average yield for the six sets has been 23.9 bushels per acre without fertilizer. One hundred pounds of nitrate of soda have produced an average gain of 31.2 per cent, equivalent to 7.5 bushels per acre, and one hundred and fifty pounds gave an average gain of 40.1 per cent, or 9.6 bushels per acre.

TABLE 6.

Corn Fertilizer Tests, Summary 1917-1921.

Test No.	Year	Yield Check Plats No Fertilizer	Increase from 100 lbs. Nitrate per acre	Nitrate per acre Increase from 150 pounds	of Land Character
1	1918	19.2±0.6 bu. per acre	4.8±0.8 bu. ar 25.1±4.1 per cent	6.2±1.8 bu. or 32.3±5.6 per cent	Loam
2	1919	22.4±1.4 bu. per acre	9.4±1.9 bu. or 42.0±8.6 per cent	13.0±2.2 bu. or 50.8±8.7 per cent	Loam
3	1921	35.2±1.2 bu. per acre	8.4±1.6 bu. or 23.8±4.4 per cent	12.9±1.6 bu. or 36.6±4.5 per cent	Loam
4	1917	25.1±0.8 bu. per acre	9.1±1.0 bu. or 36.1±4.0 per cent	11.3±1.3 bu. or 44.9±5.0 per cent	Buckshot
5	1918	22.1±0.4 bu. per acre	7.0±1.9 bu. or 31.6±8.3 per cent	7.4±1.3 bu. or 33.6±5.8 per cent	Buckshot
6	1919	19.4±0.3 bu. per acre	5.5±0.5 bu. or 28.5±2.3 per cent	8.3±0.5 bu. or 42.5±2.5 per cent	Buckshot
Averages		23.9 bu. per acre	7.4 bu. or 31.2 per cent	9.8 bu. or 40.1 per cent	

In all tests but one, cow peas have been sown in the corn middles at the last working. No apparent effect to the peas resulted from the nitrate of soda.

At the present prices of nitrate of soda and of corn, very little profit, if any at all, is to be expected from the use of this fertilizer in the ordinary corn culture as practiced on the average Delta plantation. Normally the corn crop is cheaply grown and its cultivation is rather indifferent. Further the crop is usually planted on rather thin land with the intention of improving the land with peas, sown in the middles, for the benefit of subsequent cotton crops. As a matter of fact, our average yield without fertilizer has been higher than the normal yield for this section and with no better cultivation the gain in bushels from the use of nitrate would probably be lower on the average plantation than the average gains reported here. However where corn is planted on good land and is well worked, nitrate of soda can be used profitably, because a greater increase in yield is to be expected; or even on poor land with careful and clean cultivation higher yields than the averages indicated here could very probably be the result. If the cost of the fertilizer should decline and the price of corn advance somewhat, the use of nitrate of soda for corn would become profitable even under average conditions.

Bulletin No. 208 March, 1922

PEANUTS

By
E. B. FERRIS

(Revised Edition of Bulletin No. 130)

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

PEANUTS

E. B. Ferris.

Introduction:—The peanut is perhaps our best known nut crop and combines in itself the desirable qualities of several well known farm crops. The portion above the ground makes hay superior to timothy and the equal of red clover; the underground portion a food more nutritious, acre for acre, than the best of our root crops; while at the same time, being a leguminous plant, it builds up the land on which it grows in the same way and to as great an extent as does the cowpea and velvet bean. The peanut is really not a true nut crop, but the so-called nuts are simply pods such as we find on the pea or bean which develop beneath the ground. Small yellow flowers appear at the joints where the leaves are attached, are pollinated, and the flower fades and leaves a peg-like appendage which soon lengthens and enters the ground where the pod develops. It may be interesting to note that a clover has recently been introduced into this country from Australia that has the same habit of maturing its seed beneath the ground and that when tried out in a small way in South Mississippi it has given promise of surpassing most of the other clovers.

With a growing season of from one hundred to one hundred and forty days the area of profitable production for this crop extends beyond that of cotton and includes practically all of the Southern states. It is a crop easily grown and especially well adapted to the sandy lands of South Mississippi as well as to the Coastal Plains soils of all the Southern States, being now grown in twelve of these states. As the boll weevil has spread over these states, the people have gone more and more into the production of peanuts, the production having increased from about 14,000,000 bushels in 1905 to about 53,000,000 bushels in 1917.

It is supposed to be of African origin and to have been introduced into the United States by the slave traders who used the nuts as a food for the negroes during their passage across the Atlantic. They were first introduced into Virginia and North Carolina where their culture was lagely confined until the Civil War when the value of the crop was recognized by the soldiers of the two armies who scattered them widely over the country. They are now grown in more than thirty eight states and, as stated above, commercially in twelve of them.

Virginia and North Carolina were for a long time the leading states in their production, but more recent statistics show that Alabama, Georgia and Texas in the order named each outstrip the first two states in the production of peanuts. Mississippi and Louisiana come near the last, doubtless due to the fact that the best peanut soils of these two

states, the Coastal Plains soils, are yet so largely devoted to timber or so poorly developed after being so recently cut over. South Carolina comes practically in the class with Louisiana and Mississippi, but her Coastal Plains soils have been so valuable as producers of cotton, being, until recently, free from the boll weevil, that she could not afford to use such lands for any other crop than cotton.

Varieties: There seem to be two general types of peanuts, those that spread and develop pods all along the stem and those that grow more or less upright and have the pods clustering near the base of the plant. Representative varieties of the spreading type are the Virginia Runner, Virginia Bunch and North Carolina, the pods of which are large and used chiefly for human consumption. They are generally more discriminating in their soil requirements and when grown by us were much more apt to produce faulty pods. The bunch type is represented by the Spanish peanut and several other kinds that grow upright and develop the pods around the base of the plant. There are quite a number of varieties of the Spanish type, namely "White" and "Red" Spanish, "Large" and "Small" Spanish, "Jumbo" and "Improved" Spanish and possibly others. The Valencia and Tennessee Red are upright in their growth, have the pods clustered about the base, but these pods are much larger than the regular Spanish type.

The medium or true "White" Spanish is the one best suited to general production in our section and is the one most in demand on the markets. It produces a heavy yield of pods, is upright in its growth, and much less discriminating in its soil requirements than the running or prostrate kind. When grown at McNeill this white Spanish developed a much higher percentage of its pods, even on newly cleared lands having very few pops or faulty pods. The peanut has been grown in South Mississippi largely as a feed for hogs and for such use the Spanish type is decidedly the best kind. A succession of plantings should be made in order to extend the grazing period, and in our climate such plantings may extend from April 15 to July 1. These Spanish nuts sprout badly when left in the ground after maturity and should be promptly gathered or grazed off after reaching this stage. Some of the larger kinds,, such as the Valencia, Tennessee Red and Red Spanish will stay longer in the ground without sprouting and thus increase the grazing value of the crop by extending the grazing period.

Soil Requirements—When grown for the confectioner or for roasting, peanuts demand a light sandy soil free from an excess of organic matter or from an excess of coloring matter of any kind, for the reason that the pods will partake of the color of the soil and fail to meet the demands of a discriminating trade. An ideal peanut soil should not only be physically as described above, but should have a fair percentage of lime so as to make it friable, easily crumbled and less inclined to

produce faulty pods. In the absence of a natural supply of lime, a top dressing of lime rock at the rate of 1000 pounds or more per acre will have a decidedly helpful tendency. The Spanish peanut, however, will grow successfully on almost any well drained sandy loam soil of this state, but even on such soils here lime has generally given an increase of yield though actually used on very few of our plantings of peanuts, and with present cost of lime, due to increased freight rates, we seriously doubt if increased yields will pay the cost of application.

Preparation of Land.—Land for peanuts should be prepared about the same as for cotton, which means that it should be flat broken to a medium depth and thoroughly pulverized with disc and smoothing harrows. A mistake, in our opinion, frequently made is in getting too few plants, especially of the Spanish type, to the acre. Therefore, we would prefer rows not wider than 36 inches and preferably, 30 inches, or as close as is convenient for good cultivation. After laying off the rows the fertilizer, if used, should be distributed in the drill and mixed with the soil and the nuts dropped by hand or machine and covered to a depth of from one to two inches, depending on the type of the soil, deeper on sandy than on stiff soils and still deeper if nuts are planted without shelling. The large podded nuts are usually shelled before planting and may be dropped by hand or by an ordinary corn planter, but the small Spanish nut is more often planted with the pod intact and we have always obtained earlier and better stands by soaking the pods over night and planting whole. This, too, may be done by hand or machine. In work done here these nuts have always been planted by hand, but on a visit to Andalusia, Ala., made several years ago, the writer found them using a Waters-Covington Peanut planter, manufactured by the Covington Manufacturing Co.,: Headland, Ala., that they claimed gave perfect satisfaction and was a very inexpensive machine.

The distance for planting peanuts in rows or drills is governed by the variety used, the larger and more spreading kinds requiring wider rows and greater distance in the drill than the smaller upright kind. For the Virginia runner and varieties of its type we would suggest rows three feet apart and a distance in the drill of at least fifteen inches; for the medium sized nut such as Valencia, a three foot row and a spacing of ten inches in drill; while for the small Spanish kind a row 30 inches wide and a distance not exceeding six inches will usually give the best yields. In planting without hulling we have often soaked the pods for more than 36 hours before planting and even up to 48 hours and have always gotten quicker and better germination.

On the average well drained soil of this section we have usually planted peanuts on a flat surface, covered with one or two furrows with bull tongue or cultivator, to be followed just before the plants appear above ground with smoothing harrow to knock off any surplus dirt and to kill young grass that may by this time have made its appearance.

The young peanut plant is very brittle and will not stand heavy broadcast harrowing after it appears above the ground.

Fertilizers.—While located at McNeill our station conducted a number of experiments with fertilizers under peanuts and these have led to the conclusion that acid phosphate alone on the soils here give the cheapest increase of crop. Lime has nearly always given an increase of crop and when freight rates are lower we would advise its general use on lands near enough the railroad to make the hauling and distribution reasonably cheap, but the quantity of lime used and the cost now of freighting, hauling and distributing would render its profitable use very doubtful.

The peanut being a leguminous crop, should not require a nitrogenous fertilizer and experience covering many years has gone to show that at least our newly cleared lands are not lacking in potash for many of our farm crops. The following figures giving results of work with fertilizers under peanuts in 1905 are typical of other fertilizer tests with this crop that have been made here, as may be seen by reference to work with peanuts reported in bulletins 79, 83, 87, and 94 of this station: no fertilizer, 1472 pounds; 50 lbs. nitrate of soda, 200 lbs. acid phosphate and 100 lbs. kainit, 1760 pounds; 200 lbs. acid phosphate and 100 lbs. kainit, 1792 pounds; 200 lbs. acid phosphate, 100 lbs. kainit and 1000 lbs. lime, 2016 lbs; 200 lbs. acid phosphate alone, 1760; 100 lbs. kainit alone, 1680 lbs. The above results were obtained on plats of one-sixteenth acre each and have been calculated up to an acre as a unit.

In other tests here with peanuts reverted phosphoric acid has given as good yields as the water soluble. This reverted phosphoric acid was made by mixing just enough lime to acid phosphate to render by slacking all its phosphorus insoluble in water, but soluble in a solution of ammonium citrate in the standard method of analyzing fertilizers. The yield of peanut hay has varied with the fertilizer applied, running from 1000 to 3000 pounds per acre. As a rule the more highly nitrogenous fertilizers give a slightly heavier yield of hay but not of pods. These fertilizers have generally been applied in the drills shortly before the nuts have been planted, and except where careful weighing has been necessary in plat work, an ordinary fertilizer distributer has been used for putting it out.

Cultivation.—The cultivation of the peanut does not differ materially from that given cotton or corn. It should commence even before the plants show above the ground so as to prevent the crusting of the ground above the nuts as well as to keep down weeds and grass. An ordinary weeder or section harrow either will answer the purpose and the cost will be very small. Every effort should be put forth to keep down grass, for when once started it is quite difficult to remove such

grass from the tender, spreading plants, and the cost of cleaning a foul field of peanuts may easily approach the value of the crop. After the young plants show above the ground weeds and grass should be kept down and a dust mulch maintained by frequent shallow cultivations with ordinary side harrow or cultivator. An ordinary heel sweep on Georgia stock will often do as good work in a field of peanuts as any implement that can be had. Of course these implements should never be run close enough to disturb the root development and care must be taken to send the fruit stems or pegs into the ground. The old practice of throwing dirt on top of the vines so as to get them to lie on the ground and allow the fruit stems to get beneath the surface not only is expensive and does no good but is positively injurious in many instances, according to the best authorities. It certainly does no good with the erect growing kinds that bunch their pods around a narrow space near the stem, but if practiced would make it impossible to cut such tops for hay and would thus destroy a considerable portion of the value of the crop.

Harvesting.—The true Spanish peanut, the variety that does best on the soils of this section, is, of all others, the most apt to sprout in the ground after reaching maturity and should, therefore, be harvested promptly when fully developed. If not harvested at maturity the leaves fall, the stems get weak and break easily, thus separating the nuts from the vines and making the operation of getting the nuts out of the soil much more expensive. Peanuts planted here in early spring would reach maturity near the first of September, at a time when showers are frequent so near the Coast as we are. If planted in June, these nuts should ripen near the middle of October when our weather is usually dry and conditions for saving a good quality of nuts and vines almost ideal. A crop of peanuts following one of oats may usually be harvested at the most opportune time and we have found the two crops make an excellent combination.

Our experience has been that the Spanish peanut, if harvested when just mature, may be pulled out of the ground by hand without previous loosening of the soil and that practically all the nuts will be removed. If these nuts do not come with the vine it may be necessary to loosen the soil and separate the clusters of nuts from the root system. For this there are special plows as well as special plow point to be attached to regular stocks, that may be had on the market. A simple and inexpensive type of peanut digger may be made by any blacksmith from a steel bar curved and sharpened and attached to a Georgia stock. Also an implement used to dig sweet potatoes, a middle burster with pronged mold boards, will do excellent work. In fact, the ordinary potato digger used by large growers in harvesting Irish potatoes can be used to perfection in harvesting peanuts. The large spreading varieties of peanuts are not so easily pulled out of the ground as

re the upright cluster kind and one of the other of the methods of gging will generally have to be used.

When the weather is clear and dry we often pull up the vines, turn the nuts up to the sun, and leave them to cure for a few days without going to the trouble of stacking them carefully around a pole. After thus drying out, they are raked into winrdows, stacked in small cocks and allowed to remain several days in the field where curing is continued, then they are hauled to barn, stacked away under shelter and the nuts picked from the vines or threshed later. When harvested in the fall, such a method is usually practicable but if weather conditions are not just right another method of harvesting should be used. By this, hands follow quickly behind the plow or other apparatus used for loosening the nuts, pick up the vines, shake off the dirt and leave them unpiled for six or seven hours when several rows are thrown together and finally stacked for curing.

One of the best methods of curing them is to stack the vines with nuts attached around poles seven or eight feet high, placed securely in the ground and so distributed over the field as to accomodate the crop. A platform of old rails or brush is then made around each pole or pieces of plank nailed on to these poles at right angles to each other just above the ground, so as to keep the vines off the ground and give a free circulation of air under them. The peanuts are stacked so as to have the vines on the outside and the nuts next to the pole. It is necessary to occasionally put a vine around the pole so as to keep the stack from spreading. The stacks are then capped with a grass hay or corn fodder and left for about six weeks when the nuts should be dry enough to gather, which may be done in the field, or preferably, the crop hauled to the barn and the nuts picked off by hand or machine. In long operations and with good weather conditions the threshing may be done cheaper in the field.

At our station we have grown Spanish peanuts almost entirely and have seldom gathered the nuts in any quantity, letting the hogs do this after first cutting the vines for hay and frequently after letting the dairy cattle have the run of the field even before hogs are turned in. Even when they have been cured and separated from the vines we have never sold them on the regular markets and if they are to be sold on such markets, they should be cured in the stacks before being picked from the vines, as otherwise they are apt to shrivel and even mold. Where used only as feed for livestock no such care is necessary and in practice we have seldom gone to the trouble of stacking at all.

Yields.—The average yield of peanuts in the United States is around 36 bushels per acre, but it is easily possible on selected land and under the best growing conditions to multiply this average yield several times. In our opinion, based on personal experience, the greatest cause of low yields is too few plants to the acre, especially with the Spanish

type of peanut. If width of rows were not wider than 30 inches and plants an average of 5 inches or less in drill we feel sure that average yields would be almost doubled although other conditions might remain the same. At the McNeill Station our average yield of nuts from the Spanish variety was 1640 pounds per acre and of hay 2452 pounds, while a single result in weighing the large Virginia peanut gave 1792 pounds of nuts and 3520 pounds of hay per acre. The large peanut did not, however, prove a sure bearer in all seasons, there being times when more than half the pods would be faulty. As grown at McNeill a bushel of field run peanuts of the large "Virginia" type weighed 20 pounds and a bushel of the small or "Spanish" type 22 pounds but as sold on the average market a bushel of the large type should weigh 22 pounds and of the Spanish type from 28 to 30 pounds.

Peanuts as soil builders.—The peanut is a leguminous plant and has the power of getting its nitrogen from the air just as do the other common legumes of the section such as cowpeas, velvet beans, soy beans and lespedeza. But the fact remains that the soil building power of any of these legumes is lessened just as we remove more or less of the crop from the land and fail to return it as threshed hay or the manure from animals that have been fed on such hay. A practical farmer in Louisiana who has had wonderful success in building up a worn cotton soil with lespedeza found that soil improvement took place very slowly so long as he cut his lespedeza and did not return the straw. He grew this lespedeza for seed and after threshing began to haul the straw back to the land, when he found the rate of improvement quite remarkable, so much so that his results have been used for years throughout that state to illustrate the power of lespedeza to build the soil and yet return a profit in so doing.

As commonly harvested, practically all of the peanut plant is taken from the land and as usually handled none of it returned as straw or manure from cattle fed on such straw or hay. Much of the soil building power of the crop is in the vines and nuts, but a considerable quantity would be left in the roots if, with the proper implement, these roots were severed just beneath the cluster of pods and left in the soil. Even then, in practice, the peanut crop would hardly approach the velvet bean as a soil builder because the latter grows in such a way as to make it practically impossible to remove more than a small percent of its accumulated plant food.

Improved methods of handling peanuts.—So long as the growth of peanuts was confined to the poorer sections of Virginia and North Carolina and only the large type of nuts produced, the handling of them was done entirely by hand labor. But when the area of profitable production spread to 12 or more states the necessity for improved machinery for such work began to make itself felt. One of the slowest and

most expensive operations connected with the commercial production of the crop is the separation of the nuts from the vines and this is especially true with the small Spanish kind so universally grown in this section.

There are two types of picking machines now on the market and the best of these have a capacity of picking 250 bushels of nuts per day. We believe the Benthall peanut picker is usually considered the best machine for the separation of nuts from vines with least breakage of pods. In recent years special concaves may be purchased for ordinary threshing machines which will do good work. In large field operations the peanuts are harvested and piled around the stakes as described elsewhere and after curing for about six weeks the picking machine or thresher may be set at convenient places in the field when the entire stacks are taken up, loaded on low swung wagons and hauled directly to the picker and as they are unloaded the pole is removed and thrown aside and the peanuts run through the machine. If peanuts are to be grown commercially a machine of some kind is absolutely necessary but a single machine could and should be used by an entire community so as to extend the period of service as much as possible. This peanut picker or thresher is the only expensive machine necessary in the commercial growing of the crop as the planters, if used, are little if any more expensive than the average planter for cotton or corn. In fact, the operation of dropping the nuts by hand and covering as you would corn is reasonably economical. The weeder that can be used so satisfactorily in cultivating the crop before and after the plants appear above the ground is an inexpensive implement and may be used in almost as many farm operations as can the section or smoothing harrow. While cultivators of various kinds may facilitate the cultivation of the crop to a degree, the old Georgia stock and heel sweep may do almost as effective work. And in harvesting, while a special potato digger may be effetively used, if available, the cost of doing the work will be little if any more if only the crude curved steel bar sharpened and attached to Georgia stock is used.

Uses.—Peanuts are used in a great many ways. Their sale as parched nuts will reach an enormous total, for they are sold on almost every corner in cities and towns; by the fruit and candy shops everywhere; while the small boy cries them on all occasions where more than two or three persons are gathered together. The nuts enter largely into the recipes of the confectioner and when parched and salted make a cheap substitute for the almond. Peanut butter has in recent years become a very common article of diet, being sold at almost every cross road store. Peanut butter may be easily made by the average housewife from recipies furnished by the county Home Economics Agent and this one article alone ought to be sufficient incentive for the growing

of peanuts by every family.

The peanut has a very high percentage of oil, 40 per cent of the shelled nuts being its available oil content and as 94 per cent of the whole nut is represented by the kernel, it may easily be seen that a bushel of the Spanish nuts weighing 30 pounds will furnish more than eleven pounds of oil. This oil is largely used as a substitute for olive oil, the cheaper grades of it being used in the manufacture of fancy soaps. Up to fifteen years ago the manufacture of oil from peanuts was confined almost entirely to the region around Marseilles, France, largely from nuts grown in Africa, India and Spain, but with the coming of the boll weevil into the South the culture of peanuts has extended to the point where oil is manufactured from them in this country. For the finer grades of oil the nuts must be shelled and hand picked and when so handled the resultant cake makes a superior feed for hogs and can be fed to them without the bad results frequently attending the feeding of cottonseed meal over long periods of time. Many of the nuts are crushed and pressed without removing the hulls and the resultant oil and cake, while not equal in quality to that from hulled nuts, have high commercial values, the cake being equal or superior in value to cottonseed meal and very valuable as a feed for all livestock.

As a natural stock food, the peanut ranks very high, the vines making hay superior to timothy and equal to red clover, while the nuts are the cheapest producers of pork, acre for acre, in all the list of hog crops. In bulletin No. 143 of the Alabama Experiment Station which gives in detail the results of three years work in producing pork from all kinds and combinations of feeds, the authors have the following to say about the peanut: "As a whole the peanut pasture was found to be more useful than any other pasture tried." The same station found that in feeding grain with the several hog crops the average amount of grain required in connection with the pasture to produce a pound of pork was: 1.77 pounds with peanuts; 2.3 pounds with chufas; 2.68 lbs with rape; 3.07 pounds with cowpeas; 3.13 pounds with sweet potatoes; and 3.70 pounds with sorghum. Similar tests at the Arkansas Station and reported in bulletin No. 73 show that one-fourth of an acre planted to peanuts produced 313 pounds of pork as compared to 109 pounds from a plat of the same size planted to corn. Peanuts make a highly nitrogeneous feed, not properly balanced when fed alone but forming an ideal combination when fed with corn.

The following tables taken from Baileys Cyclopedia of American Agriculture show the feeding value of peanut hay as compared to other standard hays and the composition of the several parts of the peanut plant with reference both to its feeding and fertilizing values.

Feeding Value of Peanut Hay as Compared with Hay of Other Crops

	DRY MATTER					
	Moisture	Protein	Fats	Carbohydrates	Crude Fiber	Crude Ash
	per cent	per cent	per cent	per cent	per cent	per cent
Peanut hay	7.83	11.75	1.84	46.95	22.11	17.04
Peanut vine	6.25	13.48	15.06	36.28	29.16	6.02
Clover hay	14.30	12.84	2.11	48.31	29.27	7.17
Timothy hay	13.50	7.17	1.97	52.94	33.41	4.51
Cowpea hay	10.29	19.72	4.04	45.15	21.99	9.10
Alfalfa	6.95	16.48	2.02	42.62	31.38	7.49

Average Composition of the Food Constituents in Different Parts of the Peanut Plant.

	IN WATER-FREE SUBSTANCE						
PEANUT	Water	Ash	Protein	Fiber	Nitrogen free extract	Fat	Nitrogen
	per cent	per cent	per cent	per cent	per cent	per cent	per cent
Kernels	7.85	2.77	29.47	4.29	14.27	49.20	4.67
Vines cut before blooming	31.20	10.64	12.63	22.32	48.34	6.07	2.02
Vines cut when fully ripe	31.91	12.08	10.81	32.28	39.81	5.02	1.73
Hay	7.83	17.04	11.75	22.11	46.95	1.84	1.88
Vines without leaves		8.80	6.25	32.95	49.49	2.50	1.00
Leaves		10.90	10.00	21.51	54.09	3.50	1.60
Roots	28.74.	9.58	7.63	48.59	31.00	3.20	1.22
Hulls	12.74	3.39	7.22	67.29	19.42	2.68	1.77
Skin (inner coat of kernel)	10.80	5.72	25.11	20.96	26.89	21.52	4.00
Meal	10.74	5.48	52.49	5.93	27.26	8.84	8.40

Fertilizing Constituents in Different Parts of the Peanut Plant

	IN THE FRESH OR AIR-DRY SUBSTANCE					
	Water	Nitrogen	Phos. Acid	Potash	Lime	Total Ash
	per cent	per cent	per cent	per cent	per cent	per cent
Peanut kernels	6.30	4.51	1.24	1.27	0.13	3.20
Peanut vines (cured)	7.83	1.76	0.29	0.98	2.08	15.70
Peanut hulls	10.60	1.14	0.17	0.95	0.81	3.00
Peanut cake (meal)	10.40	7.56	1.31	1.50	0.16	3.97

Remarks.—A study of the foregoing tables cannot fail to impress one with the marked possibilities of such a crop to Southern agriculture, especially to a section such as we have in South Mississippi where the soils are ideal for growing them. Even though, as frequently handled with reference to removing the entire crop from the land, we greatly destroy its soil building powers, still the very fact that the crop itself re-

quires no nitrogen in a fertilizer to be used under it is a decided advantage in its favor. Other non-leguminous crops must be fertilized here with nitrogenous fertilizers except when following legumes and this nitrogen adds greatly to the cost of such fertilizers. The fact is that with all our legumes, except possibly the velvet bean, we remove the bulk of their soil building properties when we use fruit and stalk as with the cowpea and soy bean while actually we puzzle our wits to find a way to save the velvet bean vine and thus remove it from the land.

As we see the situation in South Mississippi, one of our most promising lines of agricultural endeavor is the production of feeder hogs to be sold when less than one year old to feeders in other sections where grains for finishing may be grown cheaper than we can grow them. It is conceded by all who have tried growing hogs in the South that the peanut will furnish the cheapest gains of all crops tried and if all our farmers were to grow as many hogs as their circumstances would permit; would graze these hogs on available crops, on peanuts to as great an extent as seasons would warrant, they would get the cheapest gains possible from young pigs and get rid of them at a time when more and more grain would be required to produce a pound of pork, and also at a time when they must be fed on corn, a crop we cannot produce in competition with many other sections.

Nature gives every section certain advantages and disadvantages. It has given to South Mississippi a sandy loam soil with almost ideal physical properties, but lacking in at least two chemical elements necessary to the production of a crop like corn. It is true that we can supply this lacking plant food and make such soils, as they have been made, produce world beating corn crops, but our observation has been that the average crop of corn will justify only a small outlay for fertilizers. Too, the corn weevil, so far south as we are, will nearly always destroy a large part of the value of any corn stored here and the cost of buying carbon bisulphide to combat them, with the care necessary to make its use effective, is a handicap that too few of us consider. Granting that the peanut will average only 36 bushels to the acre, and this is about twice the state's average of corn, it will produce practically twice as much pork per acre as will the corn while the feeding value of the vines for hogs or cattle will materially increase the acreage value whether cut for hay or grazed off as pasture. If consumed entirely on the land where grown and the fertilizing elements left in the manure on the land itself, some 116 pounds of nitrogen will be left in the soil as may easily be calculated from the foregoing tables. Too, the fertilizer necessary to produce the average crop of peanuts need contain no nitrogen while that for the average corn crop must carry a relatively large amount.

The physical makeup of South Mississippi soils fit them especially

for the production of peanuts and such soils, the world over, are the ones that have led in the production of peanuts. Corn does best on stiffer lands; whether because of this stiffness or the accompanying increase in plant food elements, it is not necessary to say. It is sufficient to say that peanuts are better suited to our conditions than corn and we ought, at least to a certain extent, substitute them for it, especially in-so-far as we may attempt to grow crops with which to feed hogs.

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Alfalfa in the Delta

Delta Branch Station

by

G. B. Walker.

Curing Alfalfa Hay in Small Cocks

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
J. R. RICKS, DIRECTOR

Station Staff.

D. C. HULL, M. Sc.----------President of College
J. R. RICKS, M. Sc.----------Director and Chief in Agronomy
E. B. FERRIS, M.Sc.----------Assistant Director, South Miss. Branch Station
C. T. AMES, B.Sc.----------Assistant Director, Holly Springs Branch Station
G. B. WALKER, B. Sc.----------Assistant Director, Delta Branch Station.
C. B. ANDERS, B.Sc.----------Assistant Director, Raymond Branch Station
S. W. GREENE, M.Sc.----------In Charge of Coastal Plains Branch Station *
W. F. HAND, M.Sc., Ph.D.---Chemist
J. S. MOORE, M.Sc.----------Chief in Dairy Husbandry
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K. U. JONES, B.Sc., V.M.D.--Veterinarian
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———————————Dairyman
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R. N. LOBDELL, M.Sc.-------Entomologist
W. E. AYRES, B.Sc.----------Plant Breeder, Delta Branch Station
H. F. WALLACE, B.Sc.-------Assistant at Holly Springs Branch Station
F. B. RICHARDSON, B.Sc.---Horticulturist, South Mississippi Branch Station
M. E. ANDREWS, M.S.A.----Associate in Farm Management
A. C. WALTHALL----------Agricultural Editor
H. H. HARNED, M.S.----------Assistant Bacteriologist
MISS K. S. JOHNSON, A.B.--Stenographer and Clerk
D. W. McILWAIN----------Superintendent of Farm
N. V. EVANS----------Farm Foreman, South Miss. Branch Station
J. C. RYAN----------Farm Foreman, Holly Springs Branch Station
I. P. TROTTER, B.Sc.-------Farm Foreman, Delta Branch Station
D. MAXWELL ----------Foreman, Horse and Beef Barns
H. B. BROWN----------Collaborator
E. C. EWING----------Collaborator.

* In cooperation Bureau of Animal Industry, U. S. Department of Agriculture

Alfalfa in the Delta

By

G. B. WALKER

Alfalfa is decidedly the most valuable of all forage crops for the Mississippi Delta region, and, next to cotton, is possibly the most profitable and most important of all crops grown in this region. It is fast growing in favor, and will in a very short time be found growing on a large per cent of the cotton plantations in the Yazoo-Mississippi Delta. No other feed crop is as safely and as cheaply grown, nor is there any other grown with as much satisfaction to the planter or is relished by so many classes of livestock. There is an important place for it on every plantation and sufficient acreage should be grown in this crop to abundantly supply both hay and pasture for all livestock, even the very poorest season.

Recognizing its great value and its wonderful possibility in helping to bring about a better system of agriculture on the cotton plantations of this region, this Station, in 1915, began some experiments with a view of finding its soil requirements and the varieties best suited to this region.

This bulletin is prepared with a view of giving results of tests and observations made and to answering many of the more important questions that come to this Station almost daily.

WHERE TO PLANT ALFALFA

It is to be remembered that alfalfa is a very deep-rooted plant, sending its roots six to ten feet into the ground, when conditions are favorable. Therefore, for best development of this plant it must have a deep, porous, and a well-drained soil. These conditions are all obtainable in the Delta, with drainage being the controlling factor. No planter should attempt to grow alfalfa until he can provide a well drained soil. It makes little difference whether the land be loam or buckshot if it is well-drained, reasonably free of weed and grass seeds, and otherwise in good tilth. It was once thought that alfalfa could never be grown successfully on the loam soils of the Delta, but this idea has long been exploded. It is more or less true that the buckshot, or fine clay soils, when well drained, are our best alfalfa soils, but when well inoculated and freed of grasses, our loam soils produce most excellent crops of alfalfa. There are loam soils on the Delta Station farm that have produced more than five tons of hay per acre per season, and retained the stand for four years, which is as long as anyone should wish a stand to hold in this section, where cotton produces so well following alfalfa.

SHOULD DELTA LANDS BE FERTILIZED OR LIMED FOR ALFALFA?

With a view of determining whether or not lime or phosphate would increase alfalfa yields on loam soil, the work described in Table I was started in the fall of 1914, and records kept during seasons of 1915, 1916, 1917, and 1918, but on account of part of records for 1918 being questionable, none of the records for that year are included in this report.

FERTILIZER WORK WITH ALFALFA, AT DELTA STATION

1915, 1916, 1917—AVERAGE OF TWO SERIES

TABLE NO. I

Treatment per Acre	Average Pounds Field Cured Hay per Acre from Two Series			3 Years Aver'ge	Increase due to Fertilizer
	1915	1916	1917		
Untreated	8477	11898	8196	9523	0
1000 Lbs. Basic Slag	8850	13349	9209	10469	946
2000 Lbs. Rock Phosphate	8584	12937	9082	10201	678
8000 Lbs. Lime Stone	8893	13010	9523	10475	952
8000 Lbs. LimeSt. & 1000 Lbs. Slag	10186	13655	9709	11150	1627
8000lb LimeSt & 2000lb Phos. *	9356	12830	9421	10535	1012

* Raw Rock Phosphate

The materials were carefully weighed and applied in July of 1914, at the time of preparing the land. Duplicate plots of all treatments and checks were used.

The land used was the poorest and most uniform loam soil that could be found on the Station farm. As far back as there is any record the land has been cropped in cotton, and it is very probable that it has grown as many as fifty consecutive cotton crops.

The seed bed was made almost perfect, and seed planted with wheel barrow seeder on Aug. 7th, 1914. An excellent stand was secured on all plots.

From a study of Table I it will be noted that the average yearly increase due to 1000 pounds of Basic Slag per acre was 946 pounds of field-cured hay; from 2000 pounds of Raw Rock Phosphate it was 678 pounds; from 8000 pounds of Lime Stone it was 952 pounds; from 8000 pounds of Lime Stone, plus 1000 pounds of Basic Slag, it was 1627 pounds; and from 8000 pounds of Lime Stone plus 2000 pounds of Raw Rock Phosphate it was 1012 pounds of hay.

When used separately 1000 pounds of Basic Slag and 8000 pounds of Lime Stone gave practically the same increase; while 2000 pounds of Raw Rock Phosphate gave only about two-thirds as much increase. When Lime Stone was combined with Basic Slag, a very much larger increase was gotten, but when combined with Rock Phosphate very little greater increase was gotten than when the lime was used alone.

While all the applications gave substantial increases, when the cost of material, cost of transportation, and cost of applying are all taken into consideration, it seems the most practical and at the same time the most profitable application was 1,000 pounds of Basic Slag per acre. Even the advisability of this application will depend upon price of alfalfa hay and distance of land to be treated from railroad station. It will also be noted that even the check plots, which were on very thin loam lands, yielded an average of more than four and three-fourths tons of hay per acre per year.

PREPARING SEED BED

Too much stress cannot be laid on the matter of seed bed for alfalfa. With this crop, as with all other farm crops, much depends upon getting a good stand, and good stands are gotten only when the seed bed is properly prepared.

An excellent way to prepare for alfalfa is to break the land thoroughly in winter or early spring, disc and harrow thoroughly, and plant to peas broadcast as soon as danger of frost is over, using three bushels of seed per acre. As soon as peas will permit, cut clean for hay, and as soon as hay is removed, disc and harrow land thoroughly but shallow. A seed bed to be nearest ideal should be thoroughly worked and firmed with only enough loose soil to cover seed to depth of about one inch. If alfalfa is to be planted in the spring, a well-tilled cotton field with land disced and harrowed crosswise of rows sufficient to level land, affords an excellent seed bed.

WHEN TO PLANT.

By far the best time to plant alfalfa in the Mississippi Delta is in the fall. Late August to October first is usually safest. Spring planting, un-

less the land is very free from grass and weed seeds, and is thoroughly inoculated, is very uncertain. If it becomes necessary to plant in the spring, it should be done early in March or as soon as danger of hard freezing is past.

HOW MUCH SEED TO USE

When all conditions that enter into securing a good stand are ideal, it takes only a very few pounds of seed per acre to give a good stand, but we seldom, if ever, get all conditions ideal, and it is only good business to stay on the safe side and use enough seed to get a good stand under average to bad conditions. Twenty pounds per acre is generally conceded to be about the right amount, and the Station advises that at least twenty pounds be used. The best insurance against grass and weeds is a thick stand of alfalfa. Grasses get a start in vacant places or skips, and spread rapidly.

HOW TO PLANT

If one has acreage to justify it, a drill should be used. It places most of the seed at proper depth and insures a more uniform stand. If a less expensive seeder must be used the wheel barrow seeder should be used. In no

Fig. 1. Good Type, Low Priced Seeder.

case should the whirlwind type of seeder be used. In all cases, half the seed should be planted with seeder going in one direction and half when going at a right angle to direction of first seeding. This insures a more uniform distribution of seed, and consequently a more perfect stand.

Fig. No. 2—Good method covering alfalfa seed behind wheelbarrow seeder.

THE VARIETY TO BE PLANTED.

There seems to be almost as much difference in yielding ability of the different varieties and strains of alfalfa as there is in that of other farm crops, and the planter should, when possible, plant the variety that has been proven the best yielder under conditions similar to his own.

In 1916 this Station planted thirteen varieties and strains on fifty-two plots of one-seventh acre each, with a view to finding the variety or strain best suited to Delta conditions. This test was planted April 1st, 1916, on fairly well-drained buckshot land. Good stands were secured on most of the plots. There were four plots planted to each of the varieties, but they were in different parts of the field. In order to eliminate as much as possible any difference there might have been in stands, records were kept only on the three plots with best stands of each variety. Table No. 2 gives names of varieties with showing made by each, over a period of three years.

ALFALFA VARIETY WORK AT DELTA STATION—1916, 1917, 1918.

1-7 ACRE PLOTS (3 SERIES)

TABLE NO. II

VARIETY	Yield in Pounds Hay per plot (Field-Cured)			AVERAGE		Increase Over Poorest Yield
	1916	1917	1918	per Plot	per Acre	
Common	915	1276	1095	1129	7903	
Grimm No. 240	1244	1310	1277	1277	8939	1036
Disco No. 19 A	1330	1316	1323	1323	9261	1336
Baltic No. 204	1087	1480	1028	1198	8386	483
Disco No. 32 C	1239	1550	1392	1394	9758	1855
Disco No. 28	1187	1726	1456	1456	10192	2289
Disco No. 79	1114	1520	1317	1317	9219	1316
Disco No. 36	1233	1520	1406	1386	9702	1799
Disco No. 37	1222	1494	1408	1375	9625	1722
Turkestan	1015	1414	1213	1214	8498	595
Cossack	1056	1240	1148	1148	8036	133
Common S. D. No. 12	1208	1560	1434	1401	9807	1904
Common U. S. D. A.	1149	1306	1227	1227	8587	684

From a study of Table No. 2 it will be noted that Disco No. 28 and Common South Dakota No. 12, both pedigreed strains of common, or non-hardy varieties, have outyielded the recognized hardy varieties, such as Grimm and Cossack. The climate of the Yazoo-Mississippi Delta is of such a nature as to render the virtue of the so-called hardy varieties of little or no value here. Our climate is mild, and all varieties when well rooted seem to be able to stand our most severe winters. Delta planters are interested in the variety that will make the most hay, and judging from the above test, the pedigreed strains of Common are the varieties they should use. These varieties not only stand our winters well but yield more hay, and the seed usually come much cheaper than most of the highly exploited hardy strains of the North and North-West. It will be noted that Disco No. 28 made an average annual yield of 10,192 pounds of field-cured hay per acre, an in-

crease of 2289 lbs. over lowest yielding strain, while Common S.D. 12, yielded 9807 lbs.; an increase of 1904 lbs. over lowest yielder. It is interesting to note that the lowest yielding and the highest yielding plats were both planted with seed from common alfalfa, one of nondescript breeding and the other a pedigreed strain of known value—proving that with alfalfa as with most other farm crops it pays to plant seed of pedigreed strains. In this case the gain in favor of a pedigreed strain was worth at least $20.00 per acre per year, or $60.00 for the three years, while the increase in cost of seed was probably $3.00 to $4.00 per acre. Even with an increase of half that resulting in this test, a like investment in pedigreed seed is worth while.

INOCULATION

Alfalfa, like all other legumes, requires for its proper development certain species of bacteria which work upon its roots and gather nitrogen for it from the atmosphere. If these bacteria are not present in the soil, they must be supplied before the alfalfa can make its best development. In the majority of cases where alfalfa is sown for the first time, particularly in the case of our loam soils, it will need to be inoculated by some artificial means. There are several ways in which this can be done, but the most practical way is to broadcast and harrow in, before sowing the seed, some soil from a good alfalfa field where the bacteria are known to exist. At least three bushels of well pulverized soil per acre should be used. The soil should be secured with caution to avoid getting bad grass seed. Care should also be taken to get soil from a field where the alfalfa is healthy, to avoid introducing diseases in the new field. Soil for inoculating should be exposed to sunlight very little. It should be distributed and harrowed in with as little delay as possible. As a rule, the buckshot lands of the Delta do not require inoculation, but when being seeded to alfalfa for the first time, and when soil can be had from a nearby field at little expense, it will pay to inoculate such land, in that it usually insures an earlier catch and a heavier first cutting.

WHEN TO CUT FOR HAY

Alfalfa should usually be cut for hay whenever the new shoots at the crown are well started. This is always a safe guide for the early cutting, but late in the season a dry year, alfalfa is apt to turn yellow and begin shedding leaves before the shoots appear. In such case it should be cut before the shoots appear. In no case should alfalfa be allowed to remain uncut after it ceases to make growth.

ALFALFA AS A PASTURE CROP

While alfalfa is primarily a hay plant, there are few strictly pasture plants that afford more excellent pasture for all farm animals than does alfalfa. It is especially good for young, growing animals.

Alfalfa should be grazed very lightly, if at all, the first year. Neither should it be grazed when the land is wet, as tramping at such times injures the plant. It should not be used as a permanent pasture, but as a supplement to other pastures. It is well to pasture a few days after each cutting with such animals as horses and cows, to pick up small lots of hay that have fallen from wagons in hauling, and otherwise escaped the harvesting machinery. Many stands are injured by small bunches of hay being allowed to remain in field after harvesting, which smother out plants covered by them. This can be prevented by allowing cattle or horses to glean the fields after each cutting.

Alfalfa makes an excellent pasture for the dairy cow, but caution should be exercised and the cow allowed to graze only when the plants are dry. Grazing when alfalfa is wet is apt to cause bloating.

As a pasture for hogs alfalfa has few, if any equals. Hogs seem to make better use of it than any other class of livestock.

This Station, in Bulletin No. 177, reports some very remarkable results from pasturing hogs on alfalfa. In tests reported in this Bulletin, it appears that where sixty pound pigs were allowed to graze alfalfa without receiving any grain feed at all they paid $3.71 per head for ninety days grazing, or a little more than four cents per head per day, when pork is worth seven cents per pound. When a liberal ration of corn was fed in addition, the alfalfa pasture was worth five and three-fourths cents per head per day. It was also found in these tests, but not stated in Bulletin No. 177, that an average Delta Alfalfa meadow could afford grazing for ten head of sixty to one hundred pound pigs per acre, without materially affecting its hay yield. To be exact, during 1915, twelve acres of only average alfalfa furnished constant grazing during the entire summer for one hundred-twenty head of pigs weighing from 50 to 200 lbs., and then yielded an average of 3.65 tons per acre of field-cured hay.

An excellent method of grazing hogs on alfalfa is to divide the meadow into at least three fields, and arrange to cut one field at a time, at intervals of ten to twelve days, and let the pigs follow behind the harvesting. In this way the pigs are on the various fields only one-third of the time. This practice also affords tender sprouts at all times and a uniform quality of grazing, and at the same time keeps pigs from tramping down plants after they have grown tall, and ready to be cut for hay. A better grade of hay is also insured, and the alfalfa also has a better chance in battle for existence with grass and weeds. One of the big problems in grazing alfalfa with hogs is to keep grasses from choking out the alfalfa. If hogs are allowed to graze

on one field constantly they keep the alfalfa down, and leave the grasses grow.

When grazing alfalfa, hogs should have rings in their noses, or else be kept off the alfalfa altogether when the land is wet. It has been observed that hogs do little rooting in alfalfa meadows except when the land is wet, or coco grass is present.

Fig. No. 3—Nothing better for hog grazing than alfalfa.

ALFALFA A CROP FOR COCO LANDS

If there is one plant that will thrive and make a profitable crop on buckshot land badly infected with coco grass, that plant is alfalfa. If a very thick stand is secured, it will usually hold for two or three years. The coco grass sometimes, I might say usually, makes itself very much felt during the late summer, and materially lessens the yield from fourth and fifth cuttings, but the first three cuttings are usually heavy enough to make the crop profitable. The next spring the alfalfa gets an early start, and usually holds its own for three cuttings. It must be remembered that only the perfectly thick stands of alfalfa can win on badly infested coco land. It is not at all advisable to graze such meadows with hogs, particularly if the ground is wet, as they will destroy alfalfa rooting for coco nuts.

Alfalfa will do coco grass no harm. It simply wins by being earlier and a more vigorous grower in the spring and early summer.

GETTING GRASS OUT OF ALFALFA

After grass has gotten a hold in an alfalfa meadow, there is, so far the writer knows, no satisfactory way of getting it out. There are a nu ber of alfalfa cultivators recommended, but most of them tend to do abo as much harm to the alfalfa plants as they do to the grass. The greate enemy to grass in an alfalfa meadow is a perfect stand of alfalfa. Wh the stand becomes thin enough to allow grasses to grow at all seasons, is usually cheapest to plow up and re-seed—or better, plant alfalfa in anoth field and plow up the old field and follow with cotton for two or three yea when the land can be seeded to alfalfa again with safety.

ALFALFA IN THE CROP ROTATION

In planning a rotation system for Delta plantations there is no cr that will give better results than alfalfa. It is easily grown, improves t

Fig. No. 4—Cotton pays better than any other crop following alfalf

soil, makes profitable crops, will grow on almost any type of soil that is well drained, and one planting will stand about as long as is necessary to bring the average soil to a good state of fertility. One could hardly wish for a more ideal crop for rotating with cotton. In a rotating experiment at this Station, after growing alfalfa on worn buckshot land for three years, it increased the cotton yield over a check plat that had been planted continuously in cotton, $76.00 per acre the first year cotton followed alfalfa. The second and third years following the alfalfa the increases over check plats were very marked.

Summary

Alfalfa may be successfully grown on almost any type of soil in the Yazoo-Mississippi Delta, provided it is well drained and free of grass.

Every plantation should grow at least one-half acre of alfalfa for each one thousand pounds of animals kept. More acres would be better.

Alfalfa makes large yields of the very best hay. It is relished by all classes of livestock.

Alfalfa affords a most excellent pasture for hogs and other growing animals. It should not be grazed while the ground is wet, particularly if coco grass is present.

Few plants make as profitable crop on badly infested coco land as does alfalfa.

Seed beds for alfalfa should be thoroughly prepared, but well-firmed before planting.

For alfalfa, it will usually pay to treat loam soils with lime or slag, if the haul is short. 80,000 pounds of ground limestone and 1,000 pounds of Basic Slag per acre have proven about equal in effectiveness.

It is always advisable to inoculate land that has not previously grown alfalfa. A good method of inoculating is spreading 300 or 400 pounds of soil per acre from an established alfalfa field over land to be seeded.

Use 20 pounds of seed per acre.

A disc drill should be used when possible. If a cheaper seeder must be

used, the wheel barrow seeder is to be preferred.

Plant varieties suited to Southern conditions. Pedigreed strains of common alfalfa are to be preferred.

A perfect stand of alfalfa means much in yield and in fighting grasses. Grasses have little chance to grow where the stand of alfalfa is perfect.

In harvesting alfalfa make sure that the field is harvested clean. Small lots of hay left on alfalfa meadows have ruined many a good stand. They smother out the alafalfa and allow grasses to grow.

Alfalfa works well into a rotation system for the cotton plantation. It is a wonderful soil improver.

Vegetables and Truck for Home Use

DELTA BRANCH STATION

W. E. Ayres

Home-Grown Vegetables—Photographed Jan. 15, 1921.

1.—Porto Rica Sweet Potatoes. 2.—Amber Globe Turnips. 3.—Moss Curled Parsley. 4.—Nancy Hall Sweet Potatoes. 5.—Purple Top Globe Turnips. 6.—Detroit Dark Red Beet. 7.—Kelways Perfect Model Beet. 8.—Savoy Cabbage. 9.—Green Curled Kale. 10.—Blue Collard. 11.—White Collard. 12.—White Multiplier Onions.

All were grown outside in winter except the potatoes—and they were kept in an ordinary "kiln" and were fresh Jan. 15.

LET THE DELTA LIVE AT HOME.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

J. R. Ricks, Director.

STATION STAFF.

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J. R. Ricks, M. Sc.---Director and Chief in Agronomy
E. B. Ferris, M. Sc.---Assistant Director, South Mississippi Branch Station
C. T. Ames, B. Sc.---Assistant Director, Holly Springs Branch Station
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E. R. Gross, B. Sc.---Chief in Agricultural Engineering
F. C. Cottrell---Agricultural Engineering
J. C. C. Price, B. Sc.---Horticulturist
D. C. Neal, B. Sc., M. A.---Plant Pathologist
_____ ---Dairyman
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J. F. O'Kelly, B. Sc.---Plant Breeder
R. N. Lobdell, M. Sc.---Entomologist
W. E. Ayres, M. Sc.---Plant Breeder, Delta Branch Station
H. F. Wallace, B. Sc.---Assistant at Holly Springs Branch Station
F. B. Richardson, B. Sc.---Horticulturist, South Miss. Branch Station
M. E. Andrews, M. S. A.---Associate in Farm Management
A. C. Walthall---Agricultural Editor
H. H. Harned, M. S.---Assistant Bacteriologist
Miss Kittie Sue Johnson, A. B.---Stenographer and Clerk
D. W. McIlwain---Superintendent of Farm
N. V. Evans---Farm Foreman, South Miss. Branch Station
J. C. Ryan---Farm Foreman, Holly Springs Branch Station
I. P. Trotter, B. Sc.---Farm Foreman, Delta Branch Station
D. Maxwell---Foreman, Horse and Beef Barns
H. B. Brown---Collaborator
E. C. Ewing---Collaborator

*In cooperation Burea of Animal Industry, U. S. Department of Agriculture.

Vegetables and Truck for Home Use

DELTA BRANCH STATION

by

W. E. Ayres

THE COST OF LIVING question must be met by every householder. Two years ago the trouble was high prices. Now it is the lack of money. The South's greatest trouble is that too much food is bought at high prices that could and should be grown at home at practically no money cost.

An expensive if not an extravagant distributing system is responsible for most of the "High Cost of Living" of Delta farmers and villagers. Store-bought vegetables are raised by well paid gardeners on high priced land; picked, crated, pickled, dried, canned, or packed by high priced labor; transported across counties and states at high freight and express rates; distributed by jobbers, wholesalers, and retailers who must have very wide margins of profits; and so forth and so on to the table at exhortitant prices as compared with the cost of producing the same things at home.

The all-cotton farmer or planter is usually between two fires. When bad seasons bring good prices there is not enough cotton to sell to obtain cash to meet needs. When there is a good crop low prices cut the cash. For farmers to continue to produce cotton with which to buy all food, as well as feed, is inviting disaster not only to themselves but to their town and village neighbors, because such a practice causes high prices on the things that are to be bought and low prices on the salable commodity.

It is high time to give the home garden and truck patches first consideration. Gardens and truck patches should be the richest and best worked areas on the farm, and should grow something twelve months in the year. A garden properly planned to meet the family needs and thoroughly worked and having a good successsion of crops, will cut the grocery bill at least in half. The dream of easy money is a past sensation. Outsiders' profits must be reduced if those of the farmer are to be increased. HOME GROWN food yields profits to no one save the home owner, therefore, the home garden is most economical. It is an easy matter to produce on half an acre for $50.00 to $100.00, vegetables and truck which, if bought from the retail grocer, would cost $500.00 to $2,000.00. Spending cotton money for vegetables regularly is simple extravagance for any farmer.

Besides being the most economical food, vegetables are both appetizing and nourishing. They supply practically all food materials needed for full and compelte nourishment of the body. Meats may be omitted from the diet without sacrificing either the mental or physical vigor of any member of the family but not so with vegetables. They are absolutely essential.

Vegetables give variety to the diet like no other foods can, furnish water soluble vitamines and mineral matter not abundant in other foods. They furnish fibrous material which acts as a roughage and keep the food from being too concentrated. They thereby prevent constipation and other digestive troubles. Scurvey and other diseases caused by a diet of meat and dried foods give absoultely no trouble in homes using fresh and canned vegetables as a substantial part of the diet the year round. The health of any family will be materially improved by such use of vegetables. "Medicated Spring Tonics" are not used in homes where there has been sufficient green and canned vegetables in the diet through the winter months.

To meet the need for information on the various phases of home gardening, an experimental garden was begun at the Delta Station in 1920. Experiments and close observations under Delta conditions should simplify gardening operations in this section and aid in reducing living costs.

SOILS: The ideal garden soil contains an abundant supply of plant food and water and is porous enough to admit of air and circulation. The well drained loam soils are the Delta's best garden and truck areas but profitable gardens can be produced on any well drained rich soil.

SEED BED: Garden seeds are very small, hence the necessity of a well prepared, thoroughly fined seed bed. The land should be plowed, disked and harrowed twice or three times depending upon its condition. Preparation should not be stopped until the soil is mellow and the particles fine.

FERTILIZATION: It is imperative that garden and truck patches be very fertile. Stable or barn yard manure should be used in the fall at the rate of 15 to 20 tons per acre every two years. If such crops as cabbage do not grow off rapidly use nitrate of soda at the rate of 200 to 400 pounds per acre around the plants. On lands thought to be deficient in potash or phosphorus use a mixture of 650 lbs. acid phosphate, 400 lbs. of nitrate of soda, and 250 lbs. of sulphate of potash per acre. Don't be "stingy" with fertilizer and manure on truck garden crops.

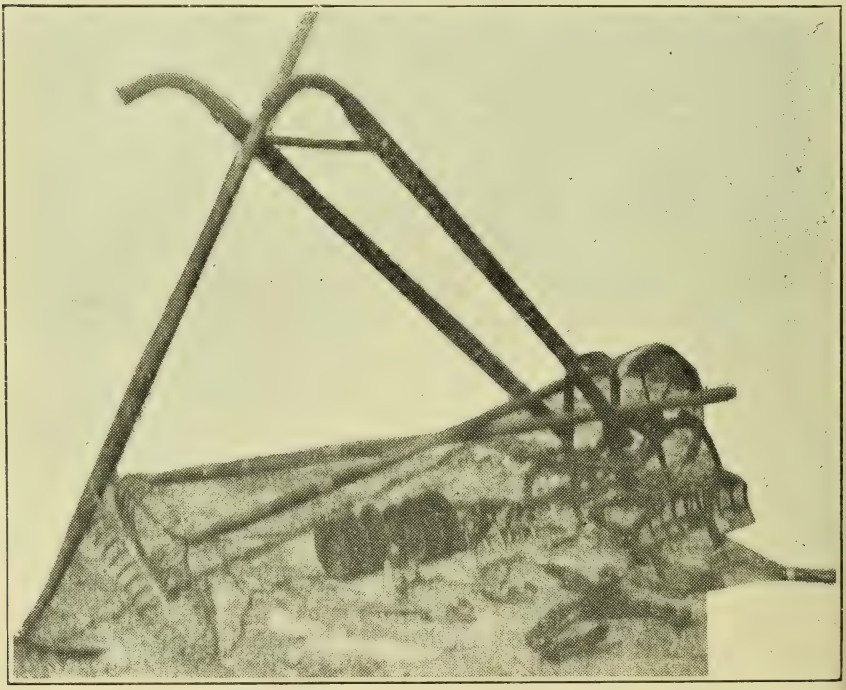

Fig. I.—Implements used to supplement horse-drawn tools in cultivating the Delta Station garden.

CULTIVATION: Garden and truck crops should be thoroughly cultivated every week or ten days and oftener if rains are frequent. No crust should be permitted, much less weeds and grass. A mule and harrow, sweep, or cultivator are very economical to use, when properly supplemented. Figure 1 shows tools used at the Delta Station to supplement the plow. In facilitate cultivation with horse drawn implements the garden should be long and narrow and should include 1-5 to 1-3 of an acre. It is desirable to have the length three times the width.

VEGETABLES AND TRUCK TO GROW: The size and likes and dislikes of the family have much to do with what should be grown but most gardens and truck patches should contain turnips, mustard, radish, spinach, lettuce, beets, cabbage, collards, asparagus, beans, peas, Irish potatoes, onions, tomatoes, egg plant, strawberries, sweet corn, watermelon, cantaloupe, cucumbers, squash, okra, and pepper. Parsley, kale, carrots, cauliflower, Swiss chard, kohl rabi, Brussels sprouts, endive, corn salad, Chinese cabbage, etc., may be gown by those who care for them.

GREENS AND SALAD PLANTS: Mustard is easily and quickly grown and furnishes an abundance of greens. It does well after February 15 until June and from Sept. 1 until Dec. 30. In mild winters it does well throughout the winter. Southern Curled yields about as much and a better quality of greens than any other variety tested.

TURNIPS furnish both greens and roots, are hardier, and are better liked by most people than mustard. Seven Top is strictly a greens variety and will stand the severest weather common to the cotton states. For fall and spring greens and for turnips other varieties must be used.

TABLE I. TURNIP VARIETY TEST, PLANTED APRIL 22, 1920.

Variety	Harvest Record					
	55 Days From Planting			Total Yield		
	No. of Turnips	Weight—Lbs. Total	Roots	No. of Turnips	Weight—Lbs. Total	Roots
Purple Top White Globe	4	1.7	1.1	63	31.1	13.5
Red Top Globe	16	11.5	5.5	89	57.5	31.4
Purple Top Strap Leaved	36	17.7	9.1	92	36.1	20.5
Early Red or Purple Top Strap Leaved	30	18.4	9.0	78	39.0	20.2
Early Snowball	20	19.9	9.0	76	57.7	31.6
Seven Top	Strictly a greens variety for winter.					
Late Test Planted Aug. 16, 1920.						
Early Red or Purple Top Strap Leaved	16	9.4	4.3	32	15.6	7.0
Extra Early Milan	33	14.4	7.5	59	22.2	12.5
Purple or Red Top Globe	2	1.9	0.8	33	-----	11.9
Early Snowball	0	0	0	26	-----	8.3
Yellow or Amber Globe	0	0	0	32	-----	12.9

One row of each variety. Rows in early test were 30 ft. long and contained 90 plants. In late test rows were 20 ft. long and had 60 plants.

Table 1 shows results of spring and fall vaiety tests in 1920. For early use Milan and Puple Top Strap Leaved are desirable. Amber Globe, Red Top Globe, Purple Top Globe, and Snowball are better for fall and early winter turnips and for late spring use. Fig. 2 shows products of some of the latter varieties harvested January 15, 1921, from Sept. 25, 1920 planting. Seed were sown Oct. 1, 1921 and turnips were available until Feb. 20, 1922.

To be able to have fresh tender greens at all times mustard and turnips should be sown every two weeks from Feb. 15 to April 15 and from Aug. 15 to Nov. 1.

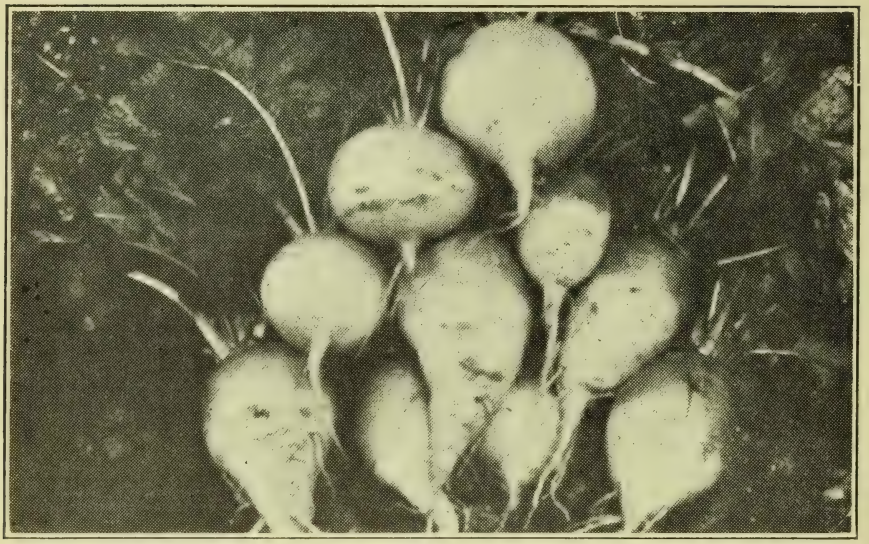

Fig. 2.—Amber Globe, Purple Top Globe, and Snow Ball turnips harvested Jan. 15 from Sept. 25 planting. A good, cheap, and easily grown vegetable.

SAVOY SPINACH may be grown as recommended above for turnips. New Zealand spinach is a summer variety which, if planted April 1, will furnish greens until frost.

COLLARDS AND KALE are very hardy and will stand the ordinary Southern winter. Planted either in May or August they have done well in the Delta experimental garden and have furnished greens at times when little else was available.

LETTUCE is rather hardy and may be raised in both fall and spring. Seed sown in hot beds, cold frames, or boxes in the living room window in January produce plants for early March setting. Seed sown in the open Sept. 1 will furnish the table in fall and early winter.

Variety tests in 1920 and 1921 were rather unsatisfactory but tend to indicate that Hubbard Market, Big Boston, and Just-In-Head are good.

CABBAGE may be grown in the open the year round, with the exception of July, August and September. For winter use, Savoy is the variety safest to use although the ordinary varieties withstand mild winters. For early spring use Jersey Wakefield is the best while Charleston Wakefield and Flat Dutch are better for later use. Plants should be set by Feb. 20 to March 1 and every two weeks until April 15.

GREENS and SALADS are very refreshing besides being valuable for the variety they give to the diet and the cellulose and minerals they yield, Enough should be planted, plantings made often enough, and enough varieties used to insure a succession throughout the open season. These vegetables are used while young and tender. The more rapid the growth the tenderer they are, hence the necessity of high fertilization and proper cultivation.

VEGETABLE FRUITS: This group includes tomatoes, egg plant, okra, pepper, etc. These are amongst the most useful vegetables. This group does well on buckshot soil.

TOMATOES are attractive and refreshing when served alone or in combination. When properly canned they keep well. A generous supply of canned tomatoes is valuable at all times but is especially so in winter when the variety of fresh vegetables is limited.

TABLE II. TOMATO VARIETY TESTS.

Variety	Yield 1st 3 Pickings			Total Yield		
	No. Fruits	Total Lbs.	Lbs. per Fruit	No. Fruits	Total Lbs.	Lbs. per Fruit
Plants set May 15, 1920 (1).						
Stone	25	8.7	0.345	290	77.7	0.267
Early Acme	4	1.6	0.400	380	90.8	0.239
Early Detroit	13	3.8	0.267	309	85.5	0.278
Ponderosa	0	0	0	231	59.4	0.257
Red Rock	24	8.2	0.340	266	73.9	0.278
Seed planted June 18, 1920—Not Transplanted (2).						
Improved Purple Acme	24	9.1	0.380	116	26.2	0.226
Chalk's Early Jewel	9	3.8	0.418	104	20.5	0.197
Redfield Beauty	18	6.1	0.341	---	13.9	---
Early Acme	13	4.1	0.315	61	15.1	0.248
Early Deroit	19	8.9	0.478	77	19.3	0.247
Ponderosa	9	3.4	0.379	56	18.6	0.332
Stone	22	8.4	0.384	97	20.3	0.210
Bonnie Best	52	14.2	0.273	---	20.8	---
Livingstone's Globe	16	5.1	0.321	96	21.0	0.219
Red Sunrise	30	6.6	0.220	99	18.9	0.191
Red Pear	0	0	0	303	11.0	0.017
Yellow Pear	0	0	0	358	17.4	0.022
Seed planted March 10—Plants set Apr. 5, 1921 (1).						
Stone	37	11.4	0.309	243	56.8	0.243
Ponderosa	3	0.8	0.267	59	27.2	0.461
Bonnie Best	37	14.2	0.384	167	78.0	0.467
Chalk's Jewell	43	12.4	0.290	380	76.7	0.202
Early Detroit	33	12.0	0.361	210	67.0	0.319
Red Sunrise	57	20.6	0.344	503	141.8	0.282
Average three Tests.						
Early Detroit	22	8.2	0.369	199	57.3	0.281
Stone	28	9.5	0.346	210	51.6	0.240
Ponderosa	4	1.4	0.215	115	35.1	0.353

(1) Plots consisted of 2 rows 36 feet long each containing 12 plants. (2) One-row plots—11 plants.

Variety tests were made in both 1920 and 1921. The results of these tests are shown in table 2. In the early test in 1920 Acme, Early Detroit, and Stone were leaders in the order named. Acme, Livingstone Globe, and Bonnie Best were the leaders in the late test in 1920, while Red Sunrise, Bonnie Best, and Chalk's Early Jewell led in the 1921 test.

Considering the weights and notes made during the two seasons Red Sunrise, Bonnie Best, Early Detroit, and Stone are probably the most dependable varieties. Early Detroit is a nice pink variety. The others are red.

Plants should be ready to set by April 15. Set 3 ft. apart at this time, and cared for they will ripen fruit by the first of July and continuously thereafter until frost. Since the old plants do not fruit rapidly after Sept. 1 it is well to cut a part of them back severely about Aug. 15, or set new plants obtained by rooting branches of the old plants by covering same with soil in July.

Five different methods of training or caring for the plants were tested. Table III shows results and figures 3 to 5 illustrate the various methods used. The method shown in figure 3 gave the best yields and is the least trouble and expensive—in the long run. Staking and tieing the plants up produced practically as good yields but is more trouble. Results indicate that pruning is both unnecessary and undesirable.

TABLE III. METHODS OF TRAINING TOMATOES.

Method of Training	Yield 1st 3 Pickings			Total Yield		
	No. Fruits	Total Lbs.	Lbs. per Fruit	No. Fruits	Total Lbs.	Lbs. per Fruit
Plants set May 15, 1920.						
Natural Growth—Not Staked	8	2.6	0.325	282	79.4	0.282
Natural Growth—Staked & Tied Up	19	7.6	0.381	539	168.6	0.313
Staked and Pruned to 2 Stems	9	3.9	0.443	303	98.7	0.326
Staked to Hog Wire Between Rows	23	7.6	0.332	410	153.7	0.375
Grown on Hog Wire Over Rows	17	6.2	0.360	542	170.4	0.314
Natural Growth—Not Staked	25	8.7	0.345	290	77.7	0.267
Plants set April 5, 1921.						
Natural Growth—Staked & Tied Up	59	17.8	0.302	309	75.6	0.245
Natural Growth—Not Staked	33	11.2	0.339	177	41.1	0.233
Staked and Pruned to 2 Stems	33	9.2	0.279	187	52.5	0.281
Staked to Hog Wire Between Rows	41	13.2	0.322	248	78 8	0.318
Natural Growth—Not Staked	29	8.2	0.283	170	40.1	0.236
Grown on Hog Wire Over Rows	35	11.0	0.315	405	85.5	0.211
Average 1920 and 1921.						
Grown on Hog Wire Over Rows	26	8.6	0.338	474	127.9	0.262
Natural Growth—Staked & Tied Up	39	12.7	0.342	424	122.1	0.304
Staked to Hog Wire Between Rows	32	10.4	0.327	329	116.2	0.347
Staked and Pruned to 2 Stems	21	6.6	0.361	245	75.6	0.304
Natural Growth—Not Staked	24	7.7	0.323	230	59.6	0.205

Plots consisted of 2 rows 36 feet long, or 24 plants.

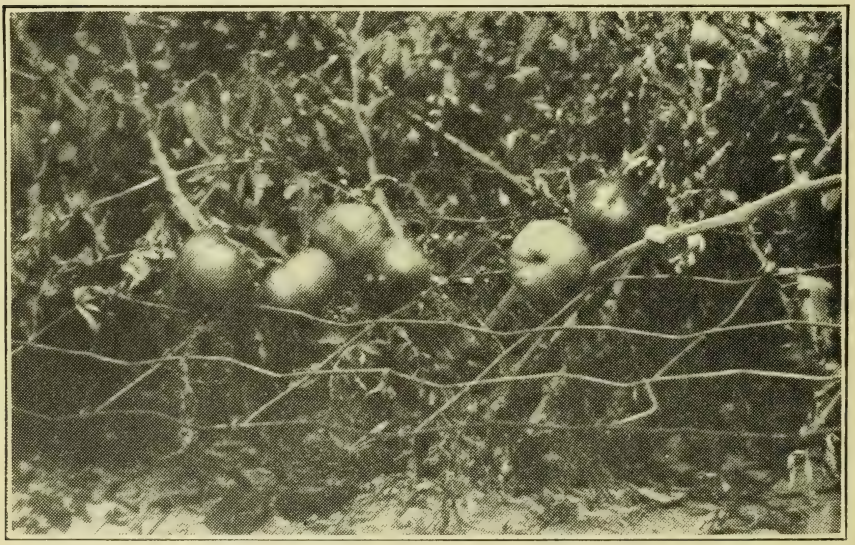

Fig. 3.—Tomatoes on hog wire stretched over the rows 12 inches from the ground. Rows two feet apart, wire placed when plants are 14 to 16 inches high. A desirable support.

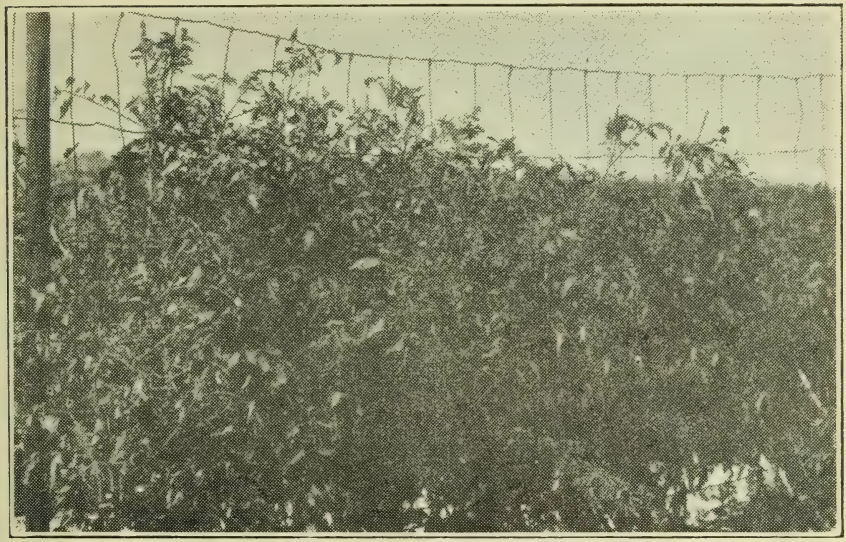

Fig. 4.—Tomatoes staked to hog wire set between 2 narrow rows. Not desirable since it is as much trouble as the method shown at the right in figure 4 and is more expensive.

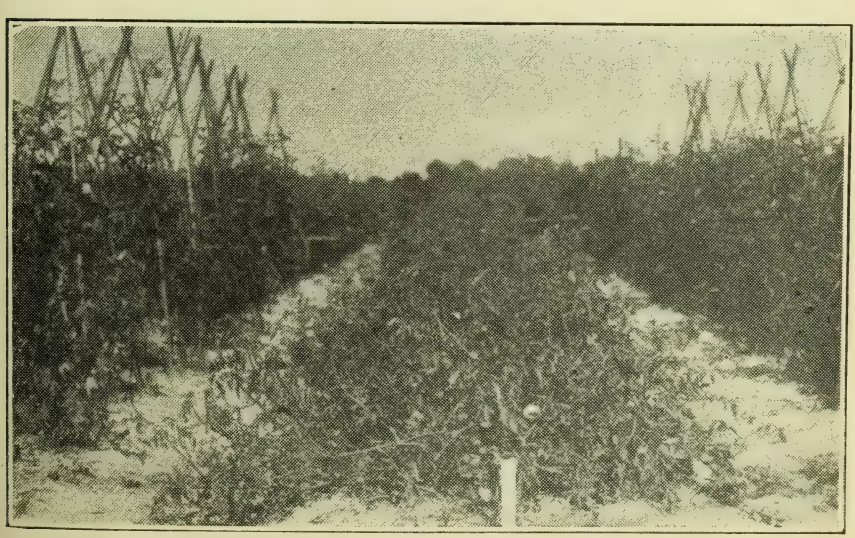

Fig. 5.—**Centre**—Tomatoes growing naturally. Left—staked, tied up, and pruned to two stems. Right—Staked and tied up, not pruned. The latter is preferable to any except that shown in figure 3 and is more desirable than that when there are plenty of stakes and no wire.

EGG PLANT is easily grown after the plants get a start but the young plants are very tender and require careful handling. No special tests were made.

OKRA variety tests were attempted both years but seed were so badly mixed that results are worth very little. It is evident, however, that a dozen plants of any good variety will furnish any ordinary family. Plant April 20 to May 1.

PEPPER variety tests have been worth very little except as observation tests but Bell or Bull Nose and Pimento seem as desirable as any edible varieties and Cayenne is a good hot pepper. Set plants about April 20 and have pepper until frost.

Plants of all this group (except okra) may be grown as outlined for lettuce, the seed being sown Feb. 20 to March 1.

ROOTS and TUBERS: Potatoes, turnips, beets, radishes, carrots, etc., make up this group. To have a succession of these it is necessary to plant all except potatoes at intervals of 7 to 14 days.

IRISH POTATOES are commonly grown. They are very starchy and should have an important place in the diet of every farm family. The crop is easily grown, requiring much less attention than the same area of vegetables.

Variety tests conducted in 1920-21, data for which are shown in table IV, indicate that Irish Cobbler, Early Ohio, and Peerless are as good as any for home use.

TABLE IV. IRISH POTATO VARIETY TESTS.

Variety	Bushels per Acre		
	Marketable	Edible	Total
1920 Results.			
Irish Cobbler	37.2	103.5	120.0
Triumph	23.7	80.1	91.2
Early Rose	19.5	63.9	74.1
Peerless	11.5	51.3	65.1
1921 Results.			
Early Ohio	55.6	84.0	87.0
Peerless	32.0	95.6	100.8
Early Rose	26.4	64.6	65.2
Irish Cobbler	28.0	51.8	55.6
Triumph	7.2	25.4	28.4
Average Results 1920 and 1921.			
Irish Cobbler	32.6	77.7	87.8
Peerless	21.8	73.5	83.0
Early Rose	23.0	64.3	69.7
Triumph	15.5	52.8	59.8
Early Ohio	Tested only one year.		

1920 tests planted April 12. 1921 test planted March 8.

Potatoes should be planted Feb. 15 to March 1. The seed should be treated for scab by soaking for 1½ to 2 hours in a solution of 1 pint of formalin in 30 gallons of water or 4 ounces of corrosive sublimate (mercuric chloride) in the same amount of water. The seed should be treated before they sprout and be dried at once. It is preferable to cut and plant, soon after treatment, 15 inches apart in 3 or 3½ foot rows.

A second crop may be planted July 10 to Aug. 10 and good results obtained when cold storage seed can be obtained, and the summer and early fall are not too dry.

SWEET POTATOES, being especially adapted to the South, should be grown on every Southern farm in sufficient quantities to supply the family table at least eight months in the year. Potatoes should be bedded March 10 to 20, the seed being soaked in either of the disenfectant solutions mentioned above for five to ten minutes. (Note difference in the period of treatment as compared with the period for Irish potatoes.) Half a bushel of seed potatoes will produce "slips" sufficient for a family of two or three persons.

TABLE V. SWEET POTATO VARIETY TEST 1920.

Variety	Bushels per Acre		Rank Based on	
	Market-able	Total Yield	Market-able	Total Yield
Triumph	412.1	546.8	1	1
Nancy Hall	315.1	439.0	3	2
Dooley	321.6	371.6	2	3
Gold Coin	308.0	343.9	4	4
Porto Rico	293.3	335.0	5	5
Bunch Yam	137.6	199.5	6	6

The variety tests reported in Table V for only one year should not be considered as being conclusive but it is rather common knowledge that Nancy Hall is one of the most desirable for table use and for Southern markets and that Triumph is a heavy yielder.

Loam or sandy loam soil is most desirable for sweet potatoes.

Turnips were discussed and results of tests given above under "Salads and Greens."

The BEET is a very useful vegetable. It can be grown in the open the entire year when the winters are not severe. In both 1920 and 1921 beets planted in April remained in the open until March and were edible at all times although not as good when old as when young and tender. Successive plantings at intervals of 10 to 20 days are desirable from April 1 to October 1.

TABLE VI. BEET VARIETY TEST, 1920

Variety	Lbs. of Roots		Rank Based on	
	Best Ten	Total	Size	Total Yield
Kelway's Perfect Model	15.4	40.7	2	1
Detroit Dark Red	15.7	38.9	1	2
Improved Early Blood Turnip	15.2	36.1	3	3
Crosby's Egyptian	14.1	35.8	4	4

Planted April 22.

Table VI shows results of the 1920 variety test. There was very little difference between yield and quality of the varieties. All those tested were good while young and tender and yielded satisfactorily.

RADISHES are hardy but the quality is not good through the summer. They may be grown in the open from Feb. 10 to June 10 and from Aug. 15 to Dec. 1. The quality is so much better when they are young that successive plantings should be made every ten days to insure fresh tender roots at all times. Scarlet and White Turnip and Long White Icicle are good varieties.

BEANS AND PEAS: This group is very rich in protein and will replace much of the meat of the diet at a saving in cost and to the advantage of the family.

BEANS are divided into two general classes: Limas and string beans. Each of these is divided into bush and pole sorts. Variety tests have been conducted with all of them but no results worthy of publication have been obtained with any except the bush string varieties. These results are given in Table VII. Rust Proof Golden Wax, Webber Wax, Bountiful, and Stringless Green Pod have been the best varieties tested considering both quailty and quantity.

Since bush beans do not have to be "stuck" they are more desirable for the average garden than the pole varieties. Bush beans planted every two weeks from April 10 to June 20 and on August 1 and 15 will provide fresh beans the greater part of the summer.

TABLE VII. BUSH BEAN VARIETY TEST

Variety	Days to Edible Beans	Lbs. Strings Beans	Size of Plant
Green Podded Varieties—1920, Planted April 22.			
Bountiful	45	39.1	Large to Very Large
Giant Stringless	49	30.4	Medium
Stringless	44	34.8	Medium
Early Red Valentine	51	34.8	Small
Earliest Red Valentine	51	28.0	Small
Wax Varieties—1920, Planted April 22			
Golden Improved	45	20.3	Very Small
Rust Proof Golden	49	38.6	Very Small
Currie's Rust Proof	44	34.5	Large
Webber	44	37.6	Small
Black German	49	31.7	Medium to Large
Late Test 1920—Planted Aug. 16			
Valentine Wax	45	17.2	
Davis White Wax	45	22.4	
Sure Crop Stringless Wax	54	8.0	
Stringless Green Pod	45	19.7	
Bountiful	42	18.5	

String Beans weigh 3-4 pound per quart and should be bought by weight rather than by measure.

Fig. 6.—Section of variety test of bush beans 1921.

Pole beans are desirable for planting in the new ground corn fields and are somewhat safer for midsummer even in the garden. Where there is plenty of cane or straight "sprouts" the sticking process is very much simplified by their use. Figure 7 shows their use for pole lima beans. This same sort of frame has been used to good advantage with tomatoes as shown in previous cuts.

Variety tests in 1920 and 1921 indicate that Dutch Case Knife and Kentucy Wonder are good varieties. The latter gives better quality snaps but the former is a week earlier and a little better yielder. Lazy Wife was

Fig. 7.—Sweet corn and lima bean test 1921. Note use of 6 ft. canes for sticking beans.

later than either of the above and produced less than one tenth as many beans as the others.

LIMA BEANS, both bush and pole, yielded very poorly both years. For this reason little information was obtained on varieties. Large White was the best of the pole varieties and Burpee's the best of the bush kinds.

Lima beans and pole snaps should be planted about the first of May.

GARDEN PEAS may be grown in the early spring and again in the fall. Spring plantings should be made every ten days from March 10 to April 20 and the fall planting about August 10.

In the variety tests in 1921 Thomas Laxton produced 37 quarts on 30 feet of row, Telephone 26 quarts, and Pioneer 23 quarts. Telephone is a late variety. The other two are early.

SWEET CORN: In the roasting ear stage sweet corn is generally liked. By making successive plantings every two weeks from March 20 to June 20 sweet corn will be available for the table most of the time from June 10 to the last of August. After this date field corn is a safer dependence if roasting ears are desired.

TABLE VIII. SWEET CORN VARIETY TEST.

Variety	No. of Ears		Lbs. of Ears		
	Before July 10	Total	Before July 10	Total	Av. Lbs. per Ear
1920 Results.					
Stowell's Evergreen	10	80	3.9	29.0	0.37
Country Gentleman	12	105	3.9	31.4	0.30
Bantam Evergreen	58	133	20.3	38.7	0.30
Early Minnesota	101	142	20.7	25.4	0.18
Golden Bantam	83	119	15.1	20.7	0.17
Golden Sugar	70	117	10.4	15.7	0.13
1921 Results.					
Stowell's Evergreen	0				
Country Gentleman	0				
Bantam Evergreen	16				
Early Minnesota	81				
Golden Sugar	12				

1920 Test Planted April 22. 1921 Test Planted April 24.

Table VIII gives results of variety tests in 1920 and partially in 1921. Stowells Evergreen, Bantam Evergreen, and Early Minnesota will serve for the home garden and give a succession. If limited to two varieties Stowell's Evergreen and Early Minnesota are to be advised, the former for the main crop and the latter for very early use.

THE VINE GROUP: Cucumbers, squash, cantaloupe, water-melon, citron, and gherkin all have a place in the garden and truck scheme of the farm. These should be planted every two weeks from April 15 to June 15.

CUCUMBERS make excellent pickles and 6 to 10 hills will furnish an ordinary family. The variety test reported in Table IX indicates that White Spine is as good as any. Records show it to have better quality than some others.

TABLE IX. CUCUMBER AND SQUASH VARIETY TEST—1920

Variety	No. Edible Fruits To July First	No. Edible Fruits Total	Rank
Cucumbers			
Arlington White Spine	106	944	1
Early White Spine	102	908	2
Snow Pickling	95	871	3
Lavis Perfect	78	696	4
Squash			
Early White Bush Scallop	31	179	1
Summer Crookneck	25	150	2

Nine hills of each variety planted April 22.

All fruits were picked when 1½ to 3 inches long or at the proper stage for pickles. The gherkin makes good pickles and is very prolific from spring until frost. Successive plantings of cucumbers are desirable.

SQUASH is relished by many and is easily grown. White Scallop is more prolific than Crookneck but the latter is golden yellow and makes a beautiful dish.

THE WATERMELON is a summer staple throughout the South for between-meals and after-supper use. Melons are luscious, healthful, and nourishing. To have an abundance throughout the season a few hills should be planted April 10 and successive plantings made every three weeks until August 10. Plantings later than June 20 are not sure to produce but cost little and are worth while when they do "hit."

TABLE X. WATERMELON VARIETY TESTS

Variety	Total Yield No.	Total Yield Lbs.	Weights Lbs. Largest Melon	Weights Lbs. Av. Melon	Days from Planting to Ripe Melons
1920 Results—Test Planted May 15th					
Kleckley Sweet	----	----	27.0	16.2	97
Georgia Rattlesnake	----	----	21.8	15.0	97
Tom Watson	----	----	20.2	16.3	104
Halbert Honey	----	----	24.0	17.0	101
1921 Results—Test Planted April 6					
Kleckley Sweet	53	745	----	14.1	76
Grey Monarch	45	649	----	14.4	76
Georgia Rattlesnake	50	839	----	16.8	76
Halbert Honey	41	679	----	16.6	69
Tom Watson	30	601	----	20.0	76

Ten hills each variety.

Variety tests reported in Table X show that Tom Watson produced the largest melons. It is a fair yielder and a good shipper. The quality of Kleckley sweet is better and it is a much better yielder. Because of their quality one-third to one-half of Georgia Rattlesnake and Grey Monarch were worthless. For home use successive plantings of Kleckley Sweet will produce a constant supply of melons of the best quality.

Fig. 8.—Delta grown Kleckley Sweets, averaging 20 pounds. Ten hills planted every three weeks from April 20 to Aug. 1 will yield an abundance of melons throughout the season if cultivated well. They will not grow wild.

The citron belongs to the same group as the watermelon and is excellent for preserves. Two or three hills planted April 20 will produce abundant supplies until frost and the melons will keep until Christmas if put where they will not freeze.

THE CANTALOUPE is one of the favorite fruits of the American table. Cantaloupes of good quality are hardly without a rival as a breakfast dessert, being delicious, nutritious, healthful, and cheap.

Successive plantings should be made as for the watermelons except that every two weeks is a better interval.

TABLE XI. CANTALOUPE VARIETY TEST—1920.

Variety	First 3 Harvests			Total Yield			Rank
	No. of Melons	Lbs. of Melons	Lbs. per Melon	No. of Melons	Lbs. of Melons	Lbs. per Melon	
Gold Lined Rockyford	4	7.0	1.75	78	140.4	1.81	1
Netted Gem	4	6.5	1.84	72	112.4	1.56	2
Banana	--	---	----	17	70.6	4.28	3
Extra Early Green Citron	10	25.0	2.50	27	60.6	2.24	4
Henderson's Bush	3	3.8	1.30	45	48.0	1.07	5

12 hills of each variety.

The variety test made in 1920 and reported in Table XI indicates that Gold Lined Rocky Ford is the best yielder. The fruit has better quailty than that of any other variety. A few hills of Green Citron for early use and the main crop Rocky Ford is a good arrangement. Banana has some merit but is not equal to Rocky Ford in either quality or production.

THE ONION GROUP: Onions, shallots, leek, garlic, etc., compose the group. They are valued primarily for their flavors, although onions are relished and used as food by many. The skillful combination of several of these flavors accounts, in a large measure, for the popularity of many French and Italian dishes. Onions, shallots and leek may be grown the year round. Yellow Bermuda, White Silver Skin, and White Multiplier are good varieties of onion. Fall planting should be done about Sept. 20 and spring planting March 1.

BERRIES: No home garden is complete without several kinds of berries. Strawberries do well in the Delta and should be more universally grown where small areas free of cocoa or nut grass are available. Klondyke seems to be better able to withstand very hot dry weather than the other varieties

Fig. 9.—Strrawberry variety test. 1.—Aroma. 2.—Klondyke. 3.—Missionary. 4.—Excelsior. The photograph was made Sept. 15. Note that the stand of most varieties has been materially reduced by the hot dry summer.

tested, as is shown in figure 9. Blackberries do well even on cocoa lands. Two or three rows 50-75 feet long will be well worth their trouble. Early Harvest and Mercereau are good varieties. The same is true of raspberries. Cuthbert and Cumberland are as good varieties as any. Owing to the decumbent habit of Dewberries they are hard to manage in cocoa land unless trellises are provided. Where they are grown Austin and Lucretia are good varieties.

GARDENS are not limited to the farm. There are few city and town lots on which a garden cannot be made. A Delta backyard garden 30 ft. square, if properly kept, can easily be made to produce 500 pounds of green vegetables worth more than $200.00 annually at retail grocery prices. Every home, whether of white or colored, should have a garden if there are ten square feet of ground available. It will help materially to KEEP DELTA COTTON DOLLARS AT HOME.

VEGETABLES are not limited in their use to the period in which they are grown. There are very few which cannot be successfully canned at home and many should be pickled, dried, preserved, or salted away for winter use. 300 quarts of fruits and vegetables is not too much for the pantry of large families and will appreciably lower the living cost.

ACKNOWLEDGEMENTS.

Professors A. B. McKay, F. B. Richardson, and J. C. C. Price gave valuable assisance in planning the general nature of the work to be done and made valuable suggestions from time to time.

Figure 8 is from a photograph made by the writer in the Arkansas Delta in 1918. It is used with the permission of the Arkansas Station.

Seed for most of the experiments were donated by the Wing Seed Company but some were furnished by Hastings.

BULLETIN No. 211 DECEMBER, 1922

REPORT FROM

Holly Springs Branch Experiment Station

FOR 1922

By C. T. AMES

PANOLA COUNTY DAY AT THE EXPERIMENT STATION

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. RICKS, Director

Holly Springs Branch Experiment Station

This bulletin contains a report of the year's work, but since results of some of the projects are incomplete, a full report could not be made at this time. Special attention has been given to soil improvement. Some new legumes have been introduced that are very promising. Six acres of level table land have been leased for special fertilizer work. While the soil is very thin, it is very desirable for experimental work, being almost level and very uniform in fertility. Twelve new varieties of alfalfa have been added to the variety test.

Cooperative fertilizer tests were made at Olive Branch and Nettleton at a very small cost. Two more such tests will be added to next year's work. Special attention has been given to the subjects of erosion, terracing, and cotton and corn culture. Variety studies with cotton, corn, and sweet potatoes have had a prominent place in this year's work. Cotton and sweet potato spacing tests and 253 fertilizer tests were made this year. The two years rotation, soy beans, and the dairy have had special attention.

EROSION

More attention is being paid to soil washing than in the past, but even now only a start has been made. County Agents are much more active in this work than heretofore. The Federal Farm Loan Banks are requiring the hill land to be terraced before any loan will be made on it. State banks in some localities are offering to finance any farmer in the purchasing of seeds and fertilizer who has his land terraced. We are convinced that many of these farms will be terraced within another generation. The consoling feature is that these lands will come back into productiveness if properly handled, regardless of how badly gullied, but the cost will be great.

The proper thing to be done is to terrace the best acre on the farm first, then the next best, and so on until the entire farm is terraced. Accurate data were kept at this station as to the cost of building terraces. The results were, as reported in Bulletin No. 165, that it cost one dollar per hundred yards to make a terrace with hired labor, the cost of teams not included. There is not a farm in the state that cannot be terraced by the labor that cultivates it, between the time the crop is gathered in the fall and the time the next crop is planted in the spring. There are but few instances where expert men cannot be secured without cost to lay off terraces.

COTTON

PREPARATION AND CULTIVATION: On account of soil washing during the heavy rains of the winter on rolling lands, it is advisable to leave as much vegetable matter on the land as possible. Only where cover crops are to be grown is it advisable to turn land in the fall, unless it is a heavy sod and the soil properly terraced or surface drained. Valley land turned in the fall will not be any the less profitable for planting in winter cover crops. A good plan to follow in preparing land for cotton is to break the land broadcast, disk and harrow, lay off in three or three and a half foot rows, as may be desired, and add the fertilizer. The two-row corn planter with a fertilizer attachment is fine for distributing the fertilizer. The rows may be covered sufficiently by running a middle breaker between them and the desired elevation secured by the use of a section harrow. The land may be bedded as is the common custom, the rows opened with a shovel plow, and the fertilizer distributed in this furrow and covered with a section harrow.

Cotton planting time is after April 25. We have become thoroughly convinced that a good stand is one of the most important factors in making good yields of cotton. We have found it very hard to secure a perfect stand by planting as early as April 20 in this latitude. This year we began planting cotton April 19, with the seed bed in ideal condition. Within a short time it began to rain, the weather became unfavorable, and our entire crop had to be planted over in May. Early planting is important, but early planting with a poor stand will not make as much cotton as that planted a week later with a perfect stand. Secure a well prepared seed bed, put fertilizer down a week before planting if you can, and plant shallow, after April 25. Most of the poor stands of cotton are results of the seed being planted too deep. Use not less than one and a half bushels of seed per acre. With the boll weevil factor in the entire state, it is advisable to plant medium early with early maturing varieties on well prepared and well fertilized soils, in narrow rows. Close spacing, six to ten inches, and frequent, shallow cultivations are advisable.

VARIETIES: This is the first year since the war that the staple cotton and short cotton brought within a few cents of the same price per pound. Before the war there was only a few cents difference per pound between short and long staple cotton. Under those conditions most of the short staple varieties ranked higher in money value than the long staple varieties in our tests at this station. From this year's work it would appear that the variety selected will have much to do with the results. At present 1-1 1/16 inch cotton seems to be in the greatest demand. In our hill land test a ¾ inch staple variety came out second in money value. We do not recommend this variety however as ¾ inch cotton is not always tenable on contracts.

RECOMMENDATIONS: We recommend the following varieties of staple cotton for valley land: Lone Star 79, Delfos 6102, Express 630, Lightning Express, Delfos 698, and Salsbury; and the following varieties of short cotton: Triumph, Acala No. 5, Trice 270-41, Cleveland Big Boll, Cleveland 54, Piedmont Cleveland, Wannamaker Cleveland, and Miller.

For hill land we recommend Triumph, Miller, Cleveland Big Boll, Cleveland 54, and Piedmont Cleveland. It will be noted that some of the varieties recommended are not in our test. Such recommendations are made because of our knowledge of the varieties.

VARIETY TEST WITH COTTON—1922

Two tests were made, one on hill and one on valley land. With an unfavorable season a poor stand was secured on both planttings, although a second planting was made. While every effort has been made to arrive at a fair value for each variety, we do not feel that our results are absolutely correct. The date of the first planting was April 19 and 21 and the second May 10 and 16.

The valley land test was on soil that did make two bales of cotton per acre seven years ago and since that time has grown a crop of vetch every other year. The late planting and the boll weevil, together with a poor stand, will account for the short crop. The hill land test was on brown loam table land that, under average conditions without the boll weevil, would make from three quarters to one bale of cotton per acre.

Tables I and II give the results of these variety tests.

TABLE No. I. VARIETY COTTON—VALLEY LAND TEST 1922

Number	VARIETY USED	Total Yield Seed Cotton per Acre.	Lint Per Cent.	Pounds of Lint Per Acre.	Length of Lint.	Value of Lint Per Pound.	Value of Lint.	Pounds of Seed Per Acre.	Value of Seed at $45.00 per Ton.	Total Money Value per Acre.	Rank in Money Value.
1	Miss. Station Trice	738.9	30.40	224.6	1- 1/16	24.50	$55.03	514.3	$11.57	$66.60	14
2	Wannamaker-Cleveland	598.9	34.57	207.0	7/8	23.75	49.15	391.9	8.82	57.97	20
3	Piedmont-Cleveland	777.8	32.87	255.7	7/8	23.75	60.73	522.1	11.75	72.48	12
4	Cleveland - 54	645.5	33.22	214.4	15/16	24.00	51.46	431.1	9.70	61.16	18
5	Half & Half	560.0	41.52	232.5	3/4	23.25	54.06	327.5	7.37	61.43	17
6	Cook 588	598.9	35.22	210.9	7/8	23.75	50.09	388.0	8.73	58.82	19
7	Miller	777.8	32.03	249.1	1-1/16	24.50	61.03	528.7	11.90	72.93	11
8	Acala No. 5	840.0	34.97	293.7	1-1/16	25.25	74.16	546.3	12.29	86.45	5
9	Lone Star - 79	956.6	29.43	281.5	1-3/16	27.00	76.01	675.1	15.19	91.20	1
10	Lone Star - 65	816.6	31.83	259.9	1-1/8	26.50	68.87	556.7	12.53	81.40	9
11	Salsbury	738.9	30.13	222.6	1-1/8	26.50	58.99	516.3	11.62	70.61	13
12	Webber 49-4	482.2	26.99	130.1	1-1/4	28.50	37.08	352.1	7.92	45.00	22
13	Webber - Deltatype	404.4	27.70	112.0	1-1/4	28.50	31.92	292.4	6.58	38.50	23
14	Sunpress	630.0	24.74	155.9	1-5/16	29.50	45.99	471.1	10.67	56.66	21
15	Delfos 631	645.5	29.82	192.5	1-1/8	28.50	54.86	453.0	10.19	65.05	16
16	Delfos 698	840.0	31.27	262.7	1-1/8	27.50	72.24	577.3	12.99	85.23	6
17	Delfos 6102	878.9	30.71	269.9	1-1/8	28.00	75.57	609.0	13.70	89.27	2
18	Express Walcott	871.1	28.03	244.2	1-1/8	27.50	67.15	626.9	14.11	81.26	10
19	Express 782	661.1	30.43	201.2	1-1/8	27.50	55.33	459.9	10.35	65.68	15
20	Express - Lightning	894.4	28.05	250.9	1-1/8	27.50	69.00	643.5	14.48	83.48	7
21	Express 630	933.3	27.85	259.9	1-1/8	27.50	71.42	673.4	15.15	86.57	4
22	Express 350	917.7	27.10	248.7	1-1/8	27.50	68.39	669.0	15.05	83.44	8
23	Triumph - Parker	941.1	31.45	296.0	1	24.50	72.52	645.1	14.51	87.03	3

TABLE No. II. VARIETY COTTON—HILL LAND TEST

Number	VARIETY USED	Total Yield Seed Cotton per Acre.	Lint Per Cent.	Pounds of Lint per Acre.	Length of Lint.	Value of Lint per Pound.	Value of Lint.	Pounds of Seed per acre.	Value of Seed at $45.00 per Ton.	Total Money Value per Acre.	Rank in Money Value.
1	Miss. Station Trice	840.0	30.40	255.4	1-1/16	$24.50	$62.57	584.6	$13.15	$75.72	4
2	Wannamaker-Cleveland	544.4	34.57	188.2	7/8	23.75	34.70	356.2	8.01	42.71	22
3	Piedmont - Cleveland	746.6	32.87	245.4	7/8	23.75	58.27	501.2	11.28	69.55	10
4	Cleveland 54	591.1	33.22	196.4	15/16	24.00	47.14	394.7	8.88	56.02	18
5	Half & Half	692.2	41.52	287.4	3/4	23.25	66.82	404.8	9.11	75.93	2
6	Cook 588	653.3	35.22	230.1	7/8	23.75	54.65	423.2	9.52	64.17	14
7	Miller	692.2	32.03	221.7	1-1/16	24.50	54.32	470.5	10.59	64.91	13
8	Acala No. 5	668.9	34.97	233.9	1-1/16	25.25	59.06	435.0	9.71	68.77	11
9	Lone Star 79	777.8	29.43	228.9	1-3/16	27.00	61.80	548.9	12.35	74.15	7
10	Lone Star 65	707.8	31.83	225.3	1-1/8	26.50	59.71	482.5	10.86	70.57	8
11	Salsbury	591.1	30.13	178.1	1-1/8	26.50	47.20	413.0	9.29	56.49	17
12	Webber 49-4	420.0	26.99	113.4	1-1/4	28.50	32.32	306.6	6.90	39.22	23
13	Webber - Deltatype	482.2	27.70	132.6	1-1/4	28.50	37.79	349.6	7.87	45.66	21
14	Sunpress	552.2	24.74	136.6	1-5/16	29.50	40.30	415.6	9.35	49.65	20
15	Delfos 631	738.9	29.82	220.3	1-1/8	28.50	62.79	518.6	11.67	74.46	6
16	Delfos 698	746.6	31.27	233.5	1-1/8	27.50	64.21	513.1	11.54	75.75	3
17	Delfos 6102	738.9	30.71	226.9	1-1/8	28.00	63.53	512.0	11.52	75.05	5
18	Express Walcott	715.5	28.03	200.6	1-1/8	27.50	55.17	514.9	11.59	66.76	12
19	Express 782	521.1	30.43	158.6	1-1/8	27.50	43.62	362.5	8.16	51.78	19
20	Express Lightning	746.6	28.05	209.4	1-1/8	27.50	57.59	537.2	12.19	69.68	9
21	Express 630	661.1	27.85	184.1	1-1/8	27.50	50.63	477.0	10.73	61.36	16
22	Express 350	700.0	27.10	189.7	1-1/8	27.50	52.17	510.3	11.58	63.75	15
23	Triumph - Parker	886.7	31.45	278.9	1	24.50	68.33	607.8	13.68	82.01	1

FERTILIZERS: In the northern and hill sections of the state, from 200 to 400 pounds of a high grade fertilizer, one that will analyze from 10 to 12 per cent phosphorous, and from 3 to 5 per cent nitrogen, should be used per acre. When a fair crop of any legume is turned under, 200 pounds of acid phosphate and fifty pounds of nitrate of soda per acre may be sufficient. A mixture of 200 pounds acid phosphate and 100 pounds nitrate of soda, or its equivalent in readily available nitrogen, is a fair application of fertilizer for this section on land of ordinary fertility. In some instances it will pay to use fifty to 100 pounds of nitrate of soda per acre in addition to the above mixture. This additional quantity may be applied as a side application to the growing crop.

It will be more necessary in the future to use fertilizer in this section than it has been in the past on account of maturing the crop earlier as the boll weevil no doubt will be a factor in the growing of cotton in this section from now on.

All mixed fertilizers should be applied before the seed is planted, but not applied more than three inches deep. When nitrate of soda is to be used to supply the nitrogen, it may be mixed as used with acid phosphate and applied before planting the seed, unless there is a heavy infestation of coco grass, in which case the acid phosphate should be applied under the seed and the nitrate of soda after the cotton has been chopped out. Heavy applications of fertilizers not properly mixed with the soil will prevent the securing of a perfect stand in some instances.

If cotton seed are soaked a few minutes in a saturated solution of nitrate of soda and water and dried a few days before planting, good results will be obtained. The nitrate of soda crystalizes on the seeds as soon as the seed come in contact with the soil moisture these crystals are dissolved and become available food for the young plants, thus giving them an early start. This method of soaking the seed hastens germination and is especially good where there is but little moisture in the soil. It only requires one or two pounds of nitrate of soda to treat a bushel of seed.

FERTILIZER TEST WITH COTTON—1922

Brown loam valley land was the type of soil used for this test. Express 350 was the variety of cotton used. It was planted April 21, but was planted over May 9 because of the poor stand received from the first planting.

TABLE No. III. FERTILIZER TEST WITH COTTON—1922

FERTILIZER USED	Series 1 Yield Seed Cotton per Acre.	Increase over Checks per Acre.	Series 2 Yield Seed Cotton per Acre.	Increase over Checks per Acre.	Av. Value of Seed Cotton per A. @ 10c per lb. for Staple Cotton.
200 lbs. Acid Phosphate	994.0	172.9	1102.0	237.7	$ 104.80
Check	821.1		864.3		84.27
400 lbs. Tenn. Phos. Rock	864.3	43.2	929.1	64.8	89.67
400 lbs. Fla. Soft Rock	1015.6	43.3	972.3	21.6	99.39
Check	972.3		950.7		96.15
200 lbs. Duplex Phosphate	1253.2	280.9	1145.2	194.5	119.92
100 lbs. Kainit	1318.1	108.1			131.81
Check	1210.0		1166.8		118.84
250 lbs. Cottonseed Meal	1404.5	194.5	1318.1	151.3	136.13
100 lbs. Nitrate Soda	1210.0	129.6	1339.7	172.9	127.48
Check	1080.4		1166.8		112.36
200 lbs. Tankage	1166.8	86.4			116.68
100 lbs. Cyanamid	1102.0	86.4	1296.5	151.3	119.92
Check	1015.6		1145.2		108.04
75 lbs. Sulphate Ammonia	1058.8	43.2	1210.0	64.8	113.44
50 lbs. Nitratee Ammonia	1426.1	367.3	1166.8	108.0	129.64
Check	1058.8		1058.8		105.88
200 lbs. Dried Blood	1145.2	86.4			114.52
25 lbs. Nitrate Ammonia &					
37½ lbs. Sulphate Ammonia	1210.0	216.0	1145.2	86.4	117.76
Check	994.0		1058.8		102.64
50 lbs. Nitrate Soda &					
125 lbs. Cottonseed Meal	1102.0	108.0	1037.2	345.8	106.96
50 lbs. Nitrate Soda &					
100 lbs. Tankage	1210.0	216.0			121.00
Check	994.0		713.1		85.35
Soak Seed in Ni. So. Sol.					
50 lbs. After First Working					
50 lbs. on July 1st	1166.8	172.8	864.3	151.2	101.55
250 lbs. Cottonseed Meal					
200 lbs. Acid Phosphate	1274.9	194.5	1382.9	172.9	132.89
Check	1080.4		1210.0		114.52
100 lbs. Nitrate Soda					
200 lbs. Acid Phosphate	1188.4	108.0	1404.5	194.5	129.64
200 lbs. Tankage					
200 lbs. Acid Phosphate	1015.6	64.9	929.1	324.1	97.23
Check	950.7		605.0		77.78
50 lbs. Nitrate Soda.					
37½ lbs. Sulphate Ammonia	827.9	86.5			82.79
75 lbs. Cyanamid					
200 lbs. Acid Phosphate	1080.4	129.7	1296.5	172.9	118.84
Check	950.7		1123.6		103.71
75 lbs. Sulphate Ammonia					
200 lbs. Acid Phosphate	1382.9	129.7	1166.8	43.2	127.48
200 lbs. Dried Blood					
200 lbs. Acid Phosphate	1512.5	259.3			151.25
Check	1253.2		669.8		125.32
100 lbs. Nitrate Soda					
400 lbs. Tenn. Phos. Rock	1361.3	172.9	864.3	194.5	111.28
100 lbs. Nitrate Soda					
400 lbs. Fla. Soft Rock	1253.2	64.8	950.7	280.9	110.19
Check	1188.4		669.8		92.91
100 lbs. Nitrate Soda					
200 lbs. Duplex Phosphate	1188.4	194.4	799.5	194.5	99.39
Check	994.0		605.0		79.95
100 lbs. Nitrate Soda					
200 lbs. Acid Phosphate					
50 lbs. Kainit	1296.5	302.5	950.7	345.7	112.36
Check	994.0		605.0		79.95

The best stand was received on the better drained parts of the land. Continued rains and the boll weevil damaged the cotton crop very much. All of the cotton pas poisoned with calcium arsenate as a weevil control measure.

It may be seen from Table III that phosphorus and nitrogen alone or in combination gave good results. It will be noted that 200 pounds of acid phosphate and 100 pounds of nitrate of soda, or 200 pounds of tankage, or 200 pounds of cottonseed meal gave good results.

FERTILIZER TESTS ON FINLEY FIELD—1922

SOIL: Six acres of very thin brown loam soil of somewhat uneven fertility were used in this test. This land has been in cultivation for fifty or more years and has the unique distinction of never having been fertilized in any way. The first years yield given in the table below should be conclusive proof of this distinction. The negro tenant who has lived on the farm for the past twenty-five years says that the main crops have been cotton and corn with no legumes of any kind. This statement will apply to thousands of acres of land in this section.

PLATS: There are 102 plats of 1/23.84 of an acre each. This land was secured very late this spring and was turned broadcast five inches deep. This is much deeper than the usual method of breaking land. Rows were made with a middle breaker and opened with a shovel plaw, the fertilizers applied as given in the tables and the land harrowed to cover the fertilizer.

DATE OF PLANTING: May 20, 1922.

VARIETY OF COTTON: Wannamaker Cleveland.

In Table IV there are twenty plats repeated four times. In the first six plats in each series and in plats from 16 to 20, the amounts of nitrogen and phosphorous remain the same and the potash (kainit) varies from 100 pounds to nothing per acre. In plats 7, 8, and 9, the nitrogen and potash remain the same and the phosphorous is varied. And, in Plats 11 to 14, the amounts of phosphorous and potash remain the same in each plat, and the kind and quantity of nitrogen is varied.

TABLE No. IV. COTTON-FERTILIZER TEST ON FINLEY FIELD—1922

Plat Number	Kind and Amount of Fertilizer Used per Acre				Yield of 4 Series of Plats in Seed Cotton				Average Plat Yield in Lbs.	Average Yield per Acre.	Value per Acre @ 9½c per Lb.
	Acid Phosphate	Cotton S. Meal	Nitrate of Soda	Kainit or Potash	Series 1	Series 2	Series 3	Series 4			
1	Check				15.25	2.50	14.50	16.75	12.25	292.0	$ 27.74
2	250	100	50	100	18.00	9.25	18.50	27.25	18.25	435.1	41.34
3	250	100	50	75	16.25	6.50	18.75	21.50	15.75	375.4	35.66
4	250	100	50	50	16.00	5.75	12.50	18.50	13.19	314.5	29.88
5	Check				5.50	.75	3.25	7.25	4.19	99.9	9.49
6	250	100	50	0	10.75	6.25	9.25	10.75	9.25	220.5	20.95
7	150	100	50	75	10.75	8.75	8.25	13.25	10.25	244.4	23.22
8	350	100	50	75	9.75	10.25	6.75	12.75	9.88	235.5	22.37
9	200	100	50	75	7.75	8.25	6.25	11.00	8.31	198.1	18.82
10	Check				2.00	2.25	1.50	2.25	2.00	47.7	4.53
11	250	100	25	75	11.00	10.00	8.00	10.00	9.75	232.4	22.08
12	250	100	75	75	13.25	13.50	10.00	10.00	11.69	278.7	26.48
13	250	100	0	75	6.25	9.25	6.75	5.50	6.94	165.5	15.72
14	250	0	50	75	7.00	10.50	9.50	6.75	8.44	201.2	19.10
15	Check				2.50	3.75	5.00	1.00	3.06	73.0	6.94
16	300	100	50	100	13.00	17.00	16.00	13.00	14.75	351.6	33.40
17	300	100	50	75	12.50	19.75	16.00	14.75	15.75	375.4	35.66
18	300	100	50	50	14.25	11.50	16.00	16.25	14.50	345.7	32.84
19	300	100	50	0	9.75	13.00	14.75	12.50	12.50	298.0	28.31
20	Check				5.00	8.00	9.00	7.50	7.38	175.9	16.71

REMARKS: The stand of cotton was almost perfect. The excessive rains caused late plantings and retarded growth. The extreme dry summer and fall caused shedding and checked growth, and also prevented boll weevil damage to any great extent.

Compare results as given in the table with different fertilizers in each series separately, then note the average.

CONCLUSIONS: 1. It pays to use fertilizer on this type of soil.

2. The soil being deficient in vegetable matter, the water supply was the controlling factor in the yield.

3. We recommend the use of 200 pounds of Acid Phosphate and 100 pounds of Nitrate of Soda per acre. Conditions, however, may warrant the use of 150 to 200 pounds of Nitrate of Soda per acre.

COOPERATIVE FERTILIZER TESTS—1922

Two pieces of land, one located on the farm of Mr. M. H. White, near Olive Branch, Mississippi, and the other on the farm of Mr. Chas. Kingsley, near Nettleton, Mississippi, were selected for cooperative tests with fertilizers, to ascertain the fertilizer requirements in those sections of the state. These pieces of land were selected by the writer and both divided into two series of thirteen plats each. The fertilizer was applied and the plat picked with the same supervision as those on the station. The cultivation, however, was left entirely to the owner of the farm.

At Olive Branch the soil is of the brown loam type, slightly rolling, though very uniform. This land had been in a lespedeza pasture for the past several years but was planted to cotton the year before, with a light application of cow manure broadcast. The variety of cotton used in this test was Piedmont Cleveland, which was planted April 21 in 3-foot rows on plats 1/36.3 of an acre in size.

The soil on the farm selected near Nettleton is of a yellowish loam type. The variety of cotton grown on this test was Miller, which was planted May 10 on plats 1/32.26 of an acre in size. The stand was not very good so we do not attach so much importance to these results.

The weevil damage was very slight at Olive Branch, but at Nettleton the damage was much greater in spite of the extremely dry weather which served as a check for the weevil.

The results of work both at Olive Branch and at Nettleton are given in Table V.

TABLE No. V. FERTILIZER TESTS ON FARMS OF MR. H. M. WHITE, OLIVE BRANCH, MISS., AND MR. CHAS. KINGSLEY, NETTLETON, MISS.

Plat Number	FERTILIZER USED	Olive Branch, Miss. Test				Nettleton, Miss. Test			
		Series 1, Yield per Acre.	Series 2, Yield per Acre.	Av. Yield per Acre.	Val. Seed Cotton @ 9½c per lb.	Series 1, Yield per Acre.	Series 2, Yield per Acre.	Av. Yield per Acre.	Val. Seed Cotton @ 9½c per lb.
1	200 lbs. Cotton S. Meal	834.9	1216.1	1025.5	$ 97.42	806.5	748.4	777.5	$ 73.86
2	200 lbs. Acid Phos.	907.5	1343.1	1125.3	106.90	800.1	744.2	787.2	74.78
3	No Fertilizer	762.3	1143.5	952.9	90.53	664.6	625.8	645.2	61.29
4	200 lbs. Acid Phos. 100 lbs. Nitrate Soda 100 lbs. Kainit	1052.7	1433.9	1243.3	118.11	883.9	935.5	909.7	86.42
5	200 lbs. Acid Phos.. 200 lbs. Cotton S. Meal	1070.9	1236.2	1153.6	109.59	780.7	1067.8	924.3	87.81
6	150 lbs. Acid Phos. 200 lbs. Cotton S. Meal 75 lbs. Kainit	1070.9	1216.1	1143.5	108.63	1045.2	984.4	1014.8	96.41
7	No Fertilizer	925.7	925.7	925.7	87.94	661.3	690.4	675.9	64.21
8	200 lbs. Acid Phos. 150 lbs. Kainit	1179.8	1236.2	1208.0	114.76	774.2	748.4	761.3	72.32
9	200 lbs. Acid Phos. 200 lbs. Cotton S. Meal 150 lbs. Kainit	1216.1	1163.6	1189.9	113.05	883.9	774.2	829.1	78.76
10	200 lbs. Acid Phos. 200 lbs. Cotton S. Meal 75 lbs. Kainit	1236.2	1070.9	1153.6	109.59	1077.5	764.6	921.1	87.50
11	No Fertilizer	1107.2	780.5	943.9	89.67	629.1	629.1	629.1	59.76
12	200 lbs. Acid Phos. 100 lbs. Nitrate Soda 75 lbs. Kainit	1288.7	1091.0	1189.9	113.90	903.3	800.1	851.7	80.91
13.	300 lbs. Acid Phos. 100 lbs. Nitrate Soda 75 lbs. Kainit	1197.9	1052.7	1125.3	106.90	903.3	822.6	863.0	81.99

CONCLUSIONS: From this year's results, it appears that the fertilizer requirements of the soils at Olive Branch and Nettleton are about the same. Both nitrogen and phosphorous, either alone or in combination, give good results. On three plats potash seemed to give some gains but on

the other potash plats it gave little or no gains. Where fruits and vegetables are to be grown a small amount of potash may be beneficial. As a fertilizer to meet the general requirements of these soils, we are recommending 100 pounds of nitrate of soda and 200 pounds of acid phosphate per acre, or its equivalent in some high grade fertilizer.

LIME AND MANURE TEST FOR COTTON AT FINLEY FIELD—1922

For this test Wannamaker Cleveland cotton was planted on thin brown loam table land. The plats were composed of seven rows, three feet wide, or 1/23.84 of an acre each. There was a blank row between each plat.

The proposed system of rotation is as follows: First year, cotton planted to rye or vetch second year, beans after rye or vetch, third year, corn and beans; fourth year, cotton. All plats are duplicated. Part of the plats are limed.

TABLE VI. COTTON YIELDS IN MANURE AND LIME TEST AT FINLEY FIELD—1922.

Plat No.	FERTILIZER USED	Cover Crop	Yld. per Acre in lbs. seed Cotton	Val. per acre Seed Cotton @ 9½c lb.
1	200 lbs. Acid Phos. and 4 tons Manure every year	Rye	309.9	$ 29.44
2	Check		238.4	22.65
3	200 lbs. Phos., 75 lbs Kainit and 4 tons manure yearly	Rye	399.3	37.94
4	200 lbs. Acid Phos. yearly and 4 tons manure every 3 years	Rye	405.3	38.51
5	200 lbs. Acid Phos. yearly		309.9	29.44
6	200 lbs. Acid. Phos. yearly & 8 tons manure every 3 yrs.	Rye	530.4	50.39
7	2 Tons of Limestone	Vetch	333.8	31.71
8	400 lbs. Phosphate Rock yearly		327.8	31.13
9	400 lbs. Phos. Rock and 4 tons manure yearly	Rye	488.7	46.44
10	200 lbs. Acid Phos. yearly & 8 tons manure every 3 yrs.	Rye	566.2	53.79
11	200 lbs. Acid Phos. yearly & 4 tons manure every 3 yrs.	Rye	381.4	36.23
12	200 lbs. Acid Phos. yearly and 2 tons Limestone	Vetch	321.8	30.57
13	400 lbs. Phos. Rock, 75 lbs. Kainit & 4 tons man. y'rly	Rye	369.5	35.11
14	Check		143.0	13.59
15	200 lbs. Acid Phos., 75 lb. Kainit & 4 tons man. yearly	Rye	274.2	26.05
16	200lbs. Acid Phosphate. yearly		208.6	19.82

REMARKS: The late planting and unfavorable season reduced the yield of cotton. The boll weevil did some damage, but the water supply was the controlling factor. This is the first years results and should be considered as only suggestive.

CONCLUSIONS: The average gain of seed cotton per ton of manure, when 200 pounds of acid phosphate was used, was 37 pounds or a gain of $3.53 per ton of manure. When 400 pounds of phosphate rock was used the gain was $3.16 per ton of manure. When kainit was used with the phosphate and manure, there was but little difference in yield.

COTTON SPACING TEST—1922

SOIL: Fertile Brown Loam Valley Land.

SIZE OF PLATS: Two-foot rows; 7 rows, 200 feet long, or 1/15.56 of an acre. Three and one-half foot rows; 6 rows, 200 feet long or 1/10.37 of an acre.

DATE OF PLANTING: April 21. Second planting May 10.

VARIETY OF COTTON: Miss. Sta. Trice.

FERTILIZER USED: Seventy-five pounds of nitrate of soda and 200 pounds of phosphate per acre. All plats were duplicated.

TABLE No. VII. COTTON SPACING TEST—1922

No. Rows	Width Rows Ft.	Plants Per Hill	Inches Between Hills	Lbs. Seed Cotton		Acre Val. Seed Cotton @ 10c
				Plat	Acre	
7	2	1	10	61.50	956.9	$ 95.69
6	3½	Unthinned	—	85.25	884.0	88.40
6	3½	1	6	86.00	891.8	89.18
6	3½	2	12	81.25	842.6	84.26
6	3½	1	12	73.75	764.8	76.48
6	3½	1	18	63.00	653.3	65.33
6	3½	1	24	53.75	557.4	55.74

REMARKS: The first planting was made April 21, 1922, under ideal conditions. Later the weather became unfavorable and the plants gradually died out. A second planting was made May 10, and then a perfect stand was not secured. The season was very wet early but extremely dry later. The late planting and boll weevils reduced the yield very much.

Two-foot rows gave 65 pounds more seed cotton per acre than any other width. We do not consider the two-foot row practical and it may not be a safe way to grow cotton on valley land every year, but it would be on hill land. A Perry cultivator does fine work on land so planted.

CONCLUSIONS: For Valley land rows 3½ feet wide and cotton two stalks to every hoes width is practical. It will be seen that 3½ foot rows and cotton six inches apart gave the highest yield not including the 2-foot row. It is easier to leave two stalks every hoes width than one stalk every six inches. It will also be seen that the wider the cotton is spaced, the less the yield after the space reaches six inches. On extremely rich valley land we suggest two stalks be left every 16 inches in rows four feet wide. This is intended to apply where cotton grows very rank.

On hill land, the rows may be reduced to thirty inches, if desired, and the cotton left from two to four stalks every hoe's width. The very wide hoe should not be used. Close spacing is the cheapest way to increase the yield of cotton. In the unthinned cotton, given in the table above, some places were found averaging eight stalks per foot. Where this was the case there were more bolls to the acre than where there were fewer stalks.

CORN CULTURE

Where such a method can be practiced, break the land broadcast, turning under a crop of vetch or velvet beans of the previous year's planting. If soil is poorly drained the land may be broken in seven-foot rows so as to plant two rows on each bed. Disk and harrow, fertilizer, and plant. But little is gained in planting corn even as early as April 15, as poor stands are the usual results of very early plantings. Plant shallow early in the season. Thin to one stalk every twenty-five or twenty-eight inches on good land and on thin land from three to four feet. Where it is necessary to use the latter distance a crop of soy beans for feed would be more profitable. A greater part of the station corn is planted after vetch during the first half of June. Some of our corn planted after vetch this year in June, yielded seventy-five bushels per acre with but little rain. Organic matter assists in retaining the water which is very necessary in making any crop.

CULTIVATION: Four or five cultivations are usually sufficient. A Perry cultivator run 2 to 3½ inches deep gives very satisfactory results. Any plow or cultivator that will leave a comparatively smooth surface and not plow deeper than 2½ to 3 inches is all right for corn culture.

The station corn crop was good this year, better than the average. Early plantings succeeded, while medium early plantings resulted in a poor stand. The weather was too dry for late plantings except on land rich in vegetable matter.

Two sets of corn and bean tests were planted and each had duplicate plats. Due to the unfavorable season and poor stands both corn and beans in some instances gave unsatisfactory results. In one instance where corn and velvet bean plats were planted back to corn and velvet beans, the yield was doubled over plats not planted to beans the year before. Two rows of

corn planted early and one row of velvet or soy beans planted two or three weeks later has been found to be the most satisfactory method of growing corn in this section. (See Cut No. 2) Velvet beans should be used on the poorer and the soy beans on the more fertile soils. In either instance the same number of stalks of corn should be grown on the two rows as should have grown on three. We have found this method will grow as many bushels of corn per acre as if every row were planted to corn and more than one-third of a bean crop besides. If corn and soy beans are to be grown for grazing, they should be planted in the same row. The two crops planted together will produce more than either planted alone.

FERTILIZER RESULTS: Corn responds as readily to the use of fertilizer as does any other crop, but as it blooms only once, unfavorable weather at that season may cause the fertilizer to prove unprofitable. When possible plant only fertile land to corn. Apply a mixture of 150 pounds of acid phosphate and 100 pounds of nitrate of soda per acre in the row before planting. If the land has been fertilized freely with acid phosphate for several years prior to corn planting, only nitrate of soda need be used. We would not think of growing corn without the use of fertilizer even though the water supply does frequently control the yield and results in little gains.

SILAGE: Probably the best corn for silage is Goliad, a very tall growing variety. Japanese Seeded Cane is relied upon entirely for silage on the station farm. This sorghum will yield from twenty-five to forty per cent heavier tonnage than corn and is about as valuable ton for ton as corn silage, if the cane is allowed to mature fully. Sorghum will stand drought better than corn. On good land with an average season, fifteen to eighteen tons per acre is a fair yield. This silage does not have to be harvested the day it is ripe as is the case with corn. We believe Japanese Seeded Cane, or varieties of that type, should be used for silage in the place of corn.

CUT No. 2
VARIETY CORN TEST—1922

SOIL: Valley Land.

PLOTS: 1 row each, repeated 6 times. Rows or checks are 3½ ft. apart with 2 stalks to the hill. Size of plot is based on actual stand of each variety.

FERTILIZER: A mixture of 200 lbs. acid phosphate and 100 lbs. nitrate of soda was applied per acre, after turning under a fair crop of crimson clover.

PLANTED: May 30, and harvested November 2.

TABLE No. VIII

Number	VARIETY	Yield in Bu. Shelled Corn per Acre.	Actual Yield in lbs. per Plot.	Actual Size of Plots on Acreage Basis.	Per Cent. of Grain.	Rank.
1	Williamson	50.72	238	1/16.69	71.5	17
2	Biggs Seven Ear	58.81	260	1/16.89	75.0	4
3	Whatley	52.46	248	1/16.73	70.8	16
4	Mosby - College	55.56	252	1/16.16	76.4	9
5	Mosby - Delta	54.17	236	1/17.14	75.0	11
6	Mosby - Ewing	57.25	255	1/16.16	77.8	7
7	Cocke - College	54.53	267	1/15.54	73.6	10
8	Cocke - Delta	56.15	249	1/16.23	77.8	8
9	Hastings Prolific	53.92	234	1/16.89	76.4	12
10	Vardaman	57.45	257	1/16.09	77.8	6
11	Marlboro	49.57	241	1/16.27	70.8	19
12	Laguna	48.63	235	1/16.02	75.0	20
13	Mexican June	53.16	244	1/16.58	73.6	13
14	Tennessee Red Cob	52.95	228	1/16.42	79.2	14
15	Paymaster Neal's	76.22	332	1/16.09	79.9	1
16	Ellis	50.33	237	1/16.58	73.6	18
17	U. S. No. 201	65.21	293	1/16.02	77.8	2
18	Florida Flint	57.78	245	1/16.97	77.8	5
19	N. C. Prolific	62.06	256	1/17.14	79.2	3
20	Reids Yellow Dent	47.83	198	1/16.93	79.9	21
21	Goliad	52.59	256	1/15.63	73.6	15

REMARKS: This corn was planted three times before a stand was secured.

VARIETIES RECOMMENDED: Neal's Paymaster, North Carolina Prolific, Mosby-Ewing's, Mosby-College and Cocke's Prolific.

SWEET POTATO FERTILIZER TEST—1922

SOIL: Brown Loam Table Land.

PLATS: Three sets of plats were used in this test. The rows were 3½ feet wide and 125 feet long and the plants were 18 inches apart in the row, the acreage being 1/33.19 of an acre.

DATE OF PLANTING: June 12, 1922.

TABLE No. IX.

Plat No.	FERTILIZER USED	PLAT YIELD			Yield in Bu. per Acre.
		Pounds Marketable	Pounds Strings	Pounds Total.	
1	200 lbs. Cotton Seed Meal	262	53	315	186.7
2	200 lbs. Acid Phosphate	261	50	311	184.3
3	No Fertilizer	259	50	309	183.3
4	200 lbs. Acid Phosphate 100 lbs. Nitrate Soda 100 lbs. Kainit	263	46	309	183.3
	200 lbs. Cotton Seed Meal 200 lbs. Acid Phosphate	266	48	314	186.1
6	150 lbs. Acid Phosphate 200 lbs. Cotton Seed Meal 75 lbs. Kainit	246	63	309	183.3
7	No Fertilizer	247	48	295	174.8
8	200 lbs. Acid Phosphate 150 lbs. Kainit	270	58	328	194.4
9	200 lbs. Acid Phosphate 200 lbs. Cotton Seed Meal 150 lbs. Kainit	261	46	307	182.0
10	200 lbs. Acid Phosphate 200 lbs. Cotton Seed Meal 75 lbs. Kainit	280	50	330	195.6
11	No Fertilizer	253	56	309	183.3
12	200 lbs Acid Phosphate 100 lbs. Nitrate Soda 75 lbs. Kainit	289	58	347	205.7
13	300 lbs. Acid Phosphate 100 lbs. Nitrate Soda 75 lbs. Kainit	233	52	285	168.9

REMARKS: Every effort was made to secure a perfect stand of potatoes. Late replants developed stem rot and were destroyed. The land was used for years in a variety test for cotton and was fertilized each year with cottonseed meal and acid phosphate.

CONCLUSIONS: It is evident that a moderate application of Acid Phosphate and Nitrate of Soda is sufficient. If Potash is necessary, it will require only a small quantity, say 75 pounds per acre. Probably the mixture in Plat 12 would be satisfactory or 400 pounds of a 8-4-3 mixed fertilizer. If the soil has not been previously fertilized, a larger quantity may be necessary.

SWEET POTATO SPACING TEST—1922

SOIL: Brown Loam Valley Land.

PLATS: One row each, 3½ feet wide and 325 feet long or 1/38.294 acre.

DATE OF PLANTING: May 26.

FERTILIZER: A mixture of 200 pounds Acid Phosphate, 100 pounds Nitrate of Soda and 25 pounds Kainit per acre. All plats were planted to Nancy Hall sweet potatoes.

TABLE No. X.

Space in Drills	Plants to Row	PLAT YIELD IN POUNDS			Yield in Bu. per Acre
		Marketable	Small	Total	
7 Inches	546	206	44	250	153.1
14 Inches	280	155	26	181	123.8
20 Inches	198	141	23	164	112.1
24 Inches	156	124	19	143	97.8

REMARKS: This is the first year's results and should not be considered conclusive. While the planting seven inches apart yielded thirty bushels more than the planting fourteen inches apart, it must be remembered that double the number of plants were required, double the cost of planting and additional trouble in hoeing; this would indicate, taking everything into consideration, that potatoes about fourteen inches apart in the row would not be far wrong a year like the last. A good potato season and a variety with a tendency to grow too large, like the Triumph, close spacing ten to twelve inches would be advisable.

SWEET POTATO VARIETY TEST—1922

SOIL: Brown Loam Valley Land.

PLATS: Two sets of plats were used in this test. There are two rows 3½ feet wide and 325 feet long in each plat. Plants are 18 inches apart in the row. Size of plat 1/19.147 of an acre.

DATE OF PLANTING: May 26.

FERTILIZER: A mixture of 200 pounds Acid Phosphate, 100 pounds Nitrate of Soda and 25 pounds of Kainit, per acre.

TABLE No. XI.

VARIETY USED	Yield of Plats No. 1 in Pounds		Total Yield of Plats per Acre in Bushels	Yield of Plats No. 2 in Pounds		Total Yield of Plats per Acre in Bushels
	Marketable	Small		Marketable	Small	
Dooley Yam	291	75	125.1	291	75	125.1
Porto Rico	512	94	207.2	450	64	175.7
Triumph	463	107	194.9	386	90	162.7
Nancy Hall	389	78	159.7	329	84	141.2

REMARKS: The season was too dry for sweet potatoes. The yield is but little over fifty per cent of a normal yield.

The Porto Rico leads in yield and in merchantable potatoes. This variety is more free from diseases than the Nancy Hall and bids fair to be the leading market potato in the South. Triumph is a good white potato, especially go for early market. It is a good keeper and sells well in some markets.

TWO YEAR ROTATION

First Year: Cotton, with vetch planted in middles at last working.

Second Year: Corn after vetch has been harvested which is early in June.

About one peck of Hairy or Spring vetch may be sown per acre prior to last working of cotton. With a good rain the vetch will germinate and make some growth in the fall. The heaviest growth is made in April and May, maturing about June first. The first year, the vetch should be allowed to fully mature before turning under so that it will reseed itself. The following spring when this land is turned to plant to cotton the vetch seed are turned to the surface. In September, when cultivation is finished and fall rains begin, the vetch germinates. After the first year the vetch may be harvested for hay when some of the seed have matured. The seed shatter out easily so plenty of seed will be left for the next crop of vetch, which is to be grown every other year.

Considerable growth of vetch is made each year but is allowed to mature seed only once in two years. There is probably enough vetch seed in our soils on the station to furnish a crop for the next five years. The above method will furnish three crops every two years and at the same time increase the fertility of the soil. Lime greatly benefits vetch. In fact, terraces, legumes, lime, and phosphorous are all required to supply the needs of these soils. Two tons of crushed limestone per acre is the minimum amount to use. All plantings of vetch should be inoculated by mixing about one-half pound of soil from a successfully growing vetch field to each pound of vetch seed. A small quantity of stable manure works like magic in getting vetch started.

SOY BEANS

The Ootootan, Lareda, and Biloxi beans have lead all other varieties grown at this station. They are all heavy producers of both seed and forage, and are late in maturing. They will require the full growing season to mature seed. The Lareda is a week or ten days earlier than the other two two varieties and for that reason is probably the best bean for this section. The seed of all three varieties germinate easily so a good stand is readily secured. To get best results, either of these varieties should be planted in 3 or 3½ foot rows and cultivated. One peck of Biloxi beans, or one gallon each of Ootootan or Lareda is sufficient to seed an acre. The yield on good land is from four to five tons of hay per acre, the Biloxi producing the coarsest hay. The seed of these varieties are scarce and expensive. It will be some years before sufficint seed will be grown to meet demands of the public.

The Mammoth Yellow soy bean has been the most popular bean grown in this section, but owing to the difficulty in securing a stand and the tendency to shatter out when matured, it is considered less valuable now. This variety is used to a large extent as food for hogs. Corn and beans are planted in the same row and the hogs are allowed to harvest the crop. This variety is also used for forage and when cut before the beans have fully matured makes a most excellent hay.

Lime at the rate of two tons of crushed limestone per acre works like magic with soy beans. Acid phosphate at the rate of 200 pounds per acre will also greatly increase the yield of both seed and vines.

DAIRYING

This section of the state is especially adapted to dairying. There is a large amount of waste land on almost every farm that could not be put to better use than making pasture for dairy cattle. Market facilities are good, as creameries and milk markets are within forty miles in any direction. These lands are especially adapted to growing grasses and forage crops. Cotton does well when fertilized with cow manure. Legumes grown to keep up soil fertility can be fed to dairy cattle and the manure returned to the farm. Labor, one of the pressing problems in dairying, is plentiful here.

CUT No. 3
BILOXI BEANS SIX FEET HIGH

In our Dairy Project, one ton of manure produced an average gain in cotton of $3.53 on very poor land the first year. This amount will probably be doubled another year with the second application. A cow properly bedded will produce around one ton of manure a month. Our cows are held under shed five months in winter. But little manure is saved except during this time yet we get about 150 tons of manure for the farm. The station averages about twenty cows in the milk barns at all times. Five of the cows are registered Jerseys. One darky does all the work of the dairy, that is, he runs the milking machine and strips all the cows, keeps a daily record of each cow, cleans the barn, drives the cows to pasture, and cleans all milking utensels. The dairy does not in any way interfere with farm work except on milk testing days, and will furnish a market on the farm for all surplus feed as well as maintain the fertility of the land.

To succeed in dairying, good cows are necessary. A greater part of the feed should be grown on the farm. Dairying and buying feed is like growing cotton and buying feed. This station feeds sorghum silage, cotton-seed meal, corn meal and leguminous hays. Corn stalks and velvet beans left in the field will almost take the place of silage if the area is sufficient to furnish the grazing. The small dairy on the farm will give constant employment to the labor and will lead to success. Growing into the dairy business is better than going into it unless one has had experience in dairying. Hogs and poultry should be a valuable adjunct to the dairy business.

LLETN NO. 212. JANUARY, 1923.

COTTON SPACING

—BY—

H. B. BROWN

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. RICKS, Director.

COTTON SPACING

—By—

H. B. BROWN

The subject of cotton spacing, or the number of plants to be left per ac one of much importance to cotton growers, and it is one that has received co erable attention from various experimenters. Results secured in different p have varied considerably. This was probably due to differences in environm conditions in different places. The environmental conditions embracing the bi cal as well as soil and climatic have an important relationship to the problem this bulletin an attempt is made to review the more important experiments that been made, and to present original data secured by the Mississippi Experiment St

A number of spacing experiments have been conducted; the majority of were carried on before the boll weevil spread over the Cotton Belt. We shall sider first spacing experiments carried on before the advent of the weevil, or wi few present that the damage done was negligible.

PRE-BOLL WEEVIL EXPERIMENTS ON SPACING PLANTS IN THE ROW ONE PLANT PER HILL.

The North Louisiana Experiment Station, at Calhoun, Louisiana (1)*, c on spacing tests with results shown in the following table:

NORTH LOUISIANA EXPERIMENT STATION.

Inches Between Hills	Pounds Seed Cotton Per Acre. 1888	1889	1893
8	1907	1942	1055
12	1785	1942	1000
16	1820	1811	945
20	1689	1653	980
24	1575		980
30	1417		
36	1391		
42	1330		
48	1146		

The soil used in the 1888 experiment was rather fertile. Spacing closer th inches gave best yields. Close spacing gave best results at this station in 188 and also in 1893 (3).

McBryde (23) in 1891 reported results from three years spacing experime three different places in South Carolina. Varying the distances within the used did not appear to affect the yields consistently.

*Numbers refer to references listed at end of bulletin.

SOUTH CAROLINA RESULTS. POUNDS OF LINT PER ACRE.

Distance Feet	At Spartanburg	At Darlington	At Two Farms
3.5x2.5		335	
3.5x3	287	358	322
3.5x3.5	361	313	337
4x2.5		348	
4x3	335	351	343
4x3.5	297	309	302
4x4	271	374	322
4.5x2.5		408	
4.5x3	280	442	361
4.5x3.5	227	328	277
4.5x4	269	383	326

Pittuck (4) in 1897 gave results from one year's spacing work on rather unfertile land at College Station, Texas. In this experiment five different varieties were used in three different distances. An average result shows best yields for the closest spacing used. The data on the comparative yields of the different varieties at different distances are not conclusive.

TEXAS RESULTS. POUNDS OF LINT PER ACRE.

Variety.	Spacing Used. 3.5x2 ft.	4x2 ft.	4x3 ft.
Bohemian (Check)	321	218	208
Jones' Prolific	217	204	273
Welborn's Pet	237	218	217
Peterkin	294	219	201
Texas Oak	204	213	184
Average	254	214	216

Redding (5) of the Georgia Experiment Station, carried on distance experiments with cotton for a long series of years. The land used was fertile and the results obtained fairly conclusive. The closer distances used almost invariably gave better yields.

GEORGIA RESULTS.

Years.	Distance and Yields Per Acre. 4x1 ft.	4x2 ft.	4x3 ft.	4x4 ft.
1891	1943	2027	2007	1833
1892	1616	1515	1501	1439
1893	1903	1905	1925	1770
1894	2065	1812	1843	1671
1895	2270	2047	1987	1767
1896	1640	1434	1369	1339
1897	1673	1727	1870	1698
1898	1881	1901	1717	1503
8 Years' Average	1874	1783	1777	1627

Director Redding (6) as a result of his experiments running through a period of seventeen years, says: "On land capable of a yield of 3-4 to 1 1-2 bales per acre, the rows should be 3 to 3.5 feet wide and the plants 12 to 18 nches apart in the drill. The narrower rows and closer spacing should be used on the less productive soil. In high latitudes the spacing should be closer than in the heart of the Cotton Belt."

Duggar (7) reports that the Alabama Experiment Station in 1886, using four

foot rows on low rich soil, secured practically the same yields for 1-, 2- and 3-foot drill spacing. But when the distance was increased to 4 feet the yield was reduced. In 1887 results from a test on the same type of soil were practically the same. In 1890 on land naturally less fertile but heavily fertilized, a distance of 2 feet in the drill gave greater yield than distances 1, 3 or 4 feet, where 4-foot rows were used, but where the rows were 3 feet wide, best yields were secured from the 3-foot spacing.

In 1891 both a cluster, Welborn, and a long limb variety, Peeler, were used in the distance experiments. The cluster variety, as was to be expected, was benefited by the closer planting, giving its maximum yield of 2519 pounds of seed cotton per acre where the plants stood 1 foot apart in the drill, while Peeler, the long limb variety, gave its best yield, 1983 pounds, with a 2-foot spacing. All rows were 4 feet wide.

In 1896 Peerless, a variety of only moderate growth, was used in the distance work, while Truitt, a growthy variety, was used in 1897. The former made its best yields when spaced closer than 24 inches, while the latter yielded practically the same at all distances below 30 inches. The rows were 3 1-2 feet apart in 1896 and 3 1-3 feet in 1897.

ALABAMA RESULTS. POUNDS SEED COTTON PER ACRE.

Inches Between Plants	Peeler 1896	Truitt 1897.
12	770	922
18	804	912
24	673	918
30	544	878
36	530	853

The North Carolina Experiment Station in 10 tests for distance at the Central Station, and in 18 tests at branch stations in the state, obtained on the average best yields with a spacing of 16 inches. Twelve inch spacing was a close second. Judging from the yields, these tests must have been conducted on land rather low in fertility.

NORTH CAROLINA RESULTS. SEED COTTON PER ACRE.

Station.	Width of Row.	No. of Tests	Inches Between Hills. 12	16	20	24
Central Station	39.6	5	1052	984	932	909
Central Station	49.5	5	951	939	877	817
Edgecomb Farm	42	4	1482	1525	1400	1459
Edgecomb Farm	48	3	1709	1726	1510	1556
Red Spring Farm	42	4	808	811	820	873
Red Spring Farm	48	3	960	989	874	831
Iredell Farm	42	4	938	1106	1015	99[illegible]
Iredell Farm	48	4	1004	927	883	873
Average			1040	1040	1126	1113

Winters and Pate (8) in recent experiments in North Carolina, report maximum yields of seed cotton at three branch stations with 16-inch spacing and best yield at the Central Station at Raleigh with 12-inch spacing.

Ayres (9) in 1917 reported results of distance experiments on rich bottom land at Scotts, Arkansas. There were some boll weevils but not enough to do serious damage. Triumph, a leafy variety, was used and planted in four-foot rows. Twelve inch spacing yielded best and 18 inch spacing next.

ARKANSAS RESULTS.

1917		1918	
Inches Between Hills	Seed Cotton Per Acre	Inches Between Hills	Seed Cotton Per Acre
6	587	3	1150
12	699	9	1065
18	678	12	1051
		18	**1039**
		36	1011

In another experiment, in which Trice cotton was used, 6-inch spacing yielded on the average 1393 pounds seed cotton, while 12-inch spacing yielded 1461.

In 1918 Ayres (10) reported other results of spacing experiments at Scotts. In these tests total yields decreased as distance between plants increased.

Ricks (11) and others, of the Mississippi Agricultural Experiment Station, conducted spacing experiments with cotton from 1910 to 1914 inclusive, on medium fertile valley land with no boll weevils or only light infestation. Four-foot rows were used. As the space between plants in the row was increased, the yield decreased invariably.

SEED COTTON PER ACRE, MISSISSIPPI RESULTS, CENTRAL STATION.

Inches in Drill	1910	1911	1912	1913	1914	Average
12	2362	1468	1332	2040	1553	1751
24	2075	1414	1264	1608	1403	1553
36	1868	1300	976	1200	1153	1299

Ames (12) in experiments carried on at the Mississippi Branch Station at Holly Springs in 1916 and 1919, secured best yields from a spacing 3 1-2 feet by 12 inches. The land was highly fertilized. In 1918, 3 feet by 9 inches gave best results; in 1920 3 1-2 feet by 18 inches. The best average for the series of years was 3 1-2 feet by 12 inches.

MISSISSIPPI RESULTS. HOLLY SPRINGS STATION.

Width Row. Ft.	Inches in Drills	Seed Cotton Per Acre			1920 Rows 3.5 feet.	
		1916	1918	1919	In. in Drill.	Seed Cotton
3	9	1175	1388	1452	6	1207
3.5	12	1421	1240	1550	12	1249
4	12		1071		18	1284
4	16	1299		1159	24	1138

Walker (13) in 1912 reported results of a spacing test planted late, June 6, on rich Delta soil. Best yields were obtained from 3 1-2 foot rows with plants spaced 2 feet in the row.

MISSISSIPPI RESULTS. DELTA STATION.

Width of Row Feet.	1 Foot in Drill	2 Feet in Drill	3 Feet in Drill
3	532	602	539
3.5	840	938	735
4	854	840	742
5	770	686	560
6	504	448	427

Balls and Holton (14) as a result of some careful spacing experiments with Egyptian cotton in Egypt in 1912 and 1913, found that maximum yields, under the prevailing conditions, were to be obtained by leaving two plants in a hill and allowing .34 square meter for each hill, or 12,000 hills per acre. Two plants per hill yielded regularly about 10 per cent more than one, both at first picking and in final yield. Their cotton was grown under irrigation, and cultivated thoroughly. Insect and fungus diseases caused very little trouble.

SUMMARY OF PRE-BOLL WEEVIL DISTANCE IN THE DRILL EXPERIMENTS

In the sixty-four spacing experiments listed in the foregoing pages, the rows varied in width to some extent, several different drill distances being used, some much more often than others. The character of the soil and climate varied. This tends to make an accurate summary, or set of averages, impossible. Yet, a survey of the results given shows that twelve-inch spacing in three and one-half to four-foot rows was first in yield in twenty-four tests given. This distance was used oftener than any other, but it averaged best. Boll weevils did little or no damage in any of these tests. On the less fertile land the closer spacing gave better yields in the majority of cases. Results from the Texas (4), Mississippi (11) and Georgia (5) Experiment Stations bear out this conclusion. On the rich lands wide spacing gave best yields in a number of cases, but the results varied widely, due probably to differences in rainfall, length of fruiting season, etc.

COTTON SPACING UNDER THE BOLL WEEVIL REGIME.

Starting in southern Texas in 1892, the cotton boll weevil gradually spread over the Cotton Belt of the United States. At present, 1922, nearly the whole of the cotton growing territory is covered. The coming of the weevil has brought about decided changes in the culture of cotton. The crop must now be cultivated and handled in such a way as to get maximum fruiting in minimum time.

Ewing, Plant Breeder for the Mississippi Delta and Pine Land Company, Scott, Mississippi, has conducted spacing experiments for several years. These tests have been made on rich land, under heavy weevil infestation, but the weevils were controlled in a measure by poisoning with calcium arsenate. Rows 3.5 wide were used and the cotton well cultivated. In every instance close spacing gave better yields than wide spacing. Distances used and yields per acre are shown in the following table:

SPACING TEST. E. C. EWING, SCOTT, MISS.

1915		1917	
Inches in Drill	Seed Cotton Per Acre	Inches in Drill	Seed Cotton Per Acre.
10	1932	6	1771
12	1739	9	1607
13.5	1589	12	1560
20	1452	18	1460
		24	1360

Ewing says: "The rule here is to chop out the cotton so that the stalks will stand hoe's width apart in the drill. With a full stand before chopping, that should leave the stalks 8 to 10 inches apart. It is important to have an even, regular stand. Where the skips are more than 12 inches, that is, where the hills have to stand more than 12 inches apart because of no plants there to begin with, then we should leave two stalks to the hill."

Ricks and Brown (11), (15) and (16), of the Mississippi Experiment Station, report results of spacing at A. & M. College in 1915, 1916 and 1917. The tests were conducted on medium fertile land with heavy weevil infestation each year. Trice cotton was used in 1915, Cleveland in 1916, and Express in 1917. The closest spacing used invariably gave best yields.

SPACING TEST, A. & M. COLLEGE, MISS.

Distance in Drill in Feet.	Pounds Cotton Seed Per Acre. 1915	1916
1	1106	576
2	988	480
3	834	450

SPACING TEST, A. & M. COLLEGE, MISS., 1917.

Inches in Drill	Pounds Seed Cotton Per Acre
4	898
8	880
18	783
24	713

Ferris (17) of the South Mississippi Branch Experiment Station, in 1920 reported results of spacing work on the rather thin sandy soils of the coastal plains. He used rows 3.5 feet wide. Weevil infestation was heavy. Yields decreased regularly as space in the drill increased.

SPACING RESULTS, SOUTH MISSISSIPPI STATION.

Inches in Drill	Pounds Seed Cotton Per Acre
10	1216
15	1108
24	1010

At the Delta Branch Experiment Station, Stoneville, Mississippi, boll weevils do considerable damage some years, while other years the injury is slight. In 1916 weevils were plentiful. Spacing work was carried on that year on soil made rich by a good crop of legumes the year before. The rows were 3 3-4 feet wide and four different varieties were used, varieties differing considerable in habit and characteristics. Walker (15) reports that Trice and Express, varieties with light foliage, made best yields with six-inch spacing, while Lone Star and Columbia, varieties with heavy foliage, yielded best with 12- and 18-inch spacing, respectively. Some rows of each variety were left unthinned, or just as left by the planter. These rows were lowest in yield in every case except in the one where Trice, a dwarfish variety with rather light foliage, was used. The unthinned rows of this variety ranked second in yield.

SPACING TEST, DELTA BRANCH EXPERIMENT STATION.

Inches in Drill	Yield of Seed Cotton Per Acre. Express 41	Trice	Lone Star	Columbia.
Unthinned	1330	1715	770	945
6	1470	1750	805	945
12	1400	1680	1120	1015
18	1470	1610	1050	1085

Tests conducted at the Delta Branch Station (18) in 1919 on soils of medium fertility gave best yields for the unthinned cotton and a regular decrease in yields for wider spacing. Very similar results were secured in 1920.

DELTA SPACING RESULTS, 1920.

Inches in Drill	Yield of Seed Cotton Per Acre. 1 Plant Per Hill	2 Plants Per Hill	Average
Unthinned			1350
8	1170	1120	1145
12	930	1090	1010
16	900	999	950
20	590	920	755
24	570	860	715
28	560	710	635
Unthinned			1340

Spacing work carried on at the same station in 1921 on soil more fertile than that used in 1919 and 1920 gave slightly better yields for 8-inch spacing than for other distances, but the 12-inch spacing was not far behind. The unthinned rows gave poorest yields.

SPACING RESULTS, DELTA BRANCH STATION.

Inches in Drill	Yield of Seed Cotton Per Acre. 1921	1922
12	1236	1011
Unthinned	903	942
8	1236	978
16	1049	986
12	1208	1022
20	1033	1023
24	1083	967
28	1099	787
12	1209	869

Spacing work at the Delta Branch Station in 1922* was on rich land and Webber 49, a rather leafy variety, was used. Results showed best yields for distances somewhat greater than for 1919 and 1920, 12, 16 and 20 inches appearing to have the lead, with no significant difference between them.

SUMMARY OF SPACING WORK UNDER BOLL WEEVIL REGIME.

In the eleven different tests conducted under boll weevil infestation, nine gave best yields with a spacing of 12 inches or closer. From this it seems that with heavy boll weevil infestation, cotton should be spaced very closely. The only question remaining to be decided is just how close it is to be spaced., that is, how much closer than 12 inches. While leaving the rows unthinned may, in some cases, give the best yields, this is uncertain, and in no case will it be practicable on account of the difficulty of removing grass and weeds. There must be room between the plants or clusters of plants for a hoe to work if the grass and weeds are to be removed easily and effectively. This requires a space of 10 or 12 inches,

*Prof. W. E. Ayres, Assistant Director of the Delta Branch Station, kindly furnished the writer with unpublished data from his spacing and delayed thinning experiments in 1922.

and often more is taken. Hoes used are seven or eight inches wide. It is impossible to get a cotton chopper to hit within an inch of the place she is looking. Too often she is not looking at the row at all.

If weevil infestation is heavy, it is not practicable to leave the plants close enough in the drill for maximum yields, provided only one plant is left in a hill. This difficulty may be avoided by leaving two or more plants in a hill, with hills a hoe's width apart. On poorer soils larger yields may be obtained usually if three or four stalks are left in a hill.

Prior to the coming of the boll weevil the fruiting season of the cotton plant was long in most parts of the Cotton Belt, and there was enough time for plants to grow large and utilize much space. It did not matter if the plants were not close together. With time, especially on rich land, they grew large and used all the space available. Under such conditions wide spacing frequently gave good returns. With heavy weevil infestation the fruit must be set in a very short time, say a month or less. This makes it necessary for more plants to be left on the land if all the space is to be used to the best advantage. There is not sufficient time for plants to grow large.

WIDTH OF ROWS.

Several experiments have been conducted in which rows of various widths were used. The results agreed very closely with distance-in-the-drill results, and this was to be expected, since the principle involved is the same in both cases, yields being dependent on the number of plants on a given area. The practicable method is to make the rows the width most convenient for cultivation, then regulate the number of plants per acre by spacing in the drill.

DISTANCE WORK ON RICH OR POOR LAND.

But very little work has been done to determine definitely the best spacing for very rich, or for very poor, soil. Most of the experiments have been conducted on soils of medium fertility. Some experimenters have not been explicit in mentioning the type of soil used. Basing conclusions on the results from the few experiments in which the type of soil is mentioned, and our general knowledge of the soil conditions in different regions where the spacing work was done, it seems that on poor land, both with boll weevil and without, cotton plants should be spaced closely, say two to four plants per hill, with hills 10 to 12 inches apart in rows 3 feet wide. Results from the Holly Springs Experiment Station (12) bear out this conclusion.

On medium rich to rich soils it is easily possible to get cotton spaced too closely if weevils are not present, say two stalks in a hill with hills closer than 12 inches in 3 1-2-foot rows. With weevils present, a close spacing is advisable, but even then not closer than the distance mentioned. Results from the Mississippi Delta Station for 1916 and 1922 throw some light on this phase of the problem.

EFFECT OF SPACING ON YIELD FIRST PICKING.

In the spacing experiments in which comparative yields of the first picking are recorded, the closer spaced cotton shows a higher per cent of its crop regularly. Duggar (7) in Alabama secured results as follows: Forty-two per cent of the whole crop was obtained the first picking, August 26, from plants spaced 12 inches apart; thirty-eight per cent from plants spaced 18 inches; thirty per cent from plants spaced 24 inches; and twenty-six per cent from plants spaced 36 inches. Redding, in Bulletin 16 of the Georgia Experiment Station, gives results as follows:

EFFECT OF SPACING ON EARLINESS. GEORGIA STATION.

Spacing	Yield Per Acre. 1st Picking	2d Picking	Total
1x4 ft.	93	611	1943
2x4 ft.	22	401	2027
3x4 ft.	25	324	2007
4x4 ft.	13	243	1833

Similar results have been obtained by others. The closer spacing is conducive to earlier maturity, or at least to earlier boll opening. If there are more plants on the ground there is a higher percentage of primary bolls, or bolls springing directly from the main stalk, or from fruit branches on the main stalk. Bolls on these parts, in the main, develop earlier than bolls on secondary branches, and if the percentage is higher, an earlier crop is produced.

NUMBER OF STALKS PER HILL.

Several tests have been made to determine whether or not there is an advantage in leaving more than one stalk of cotton in a hill. Balls and Holton (14) in some careful tests with Egyptian cotton in Egypt, secured ten per cent greater yields regularly from two stalks in a hill as compared with one stalk. Each hill had .34 square meter space. This represented 12,000 hills per acre, and is about equivalent to hills twelve inches apart in three and one-half foot rows.

Lee (2) in North Louisiana, secured better yields from two stalks in a hill at all distances except eight inches, one per hill leading at this distance. Rast, in Bulletin 115 of the Georgia College of Agriculture, reports that in tests made in Georgia, two stalks per hill elded more than one for all distances greater than fourteen inches. Ayres (9) in ltural experiments on rich bottom lands in Arkansas, secured best yields from thre lants per hill for the first picking, and best total yields from two plants per . Plants were spaced 18 inches in four-foot rows. Walker and Ayres (18) at the Mississippi Delta Experiment Station, 1919, secured better yields from two plants in a hill for 12, 16, 20, 24 and 28 inches. With 8-inch spacing, one plant per hill led over two by a margin of fifty pounds of seed cotton per acre.

From the tests made it appears that for distances that are practicable for cultivation 12 inches or above, that two plants per hill will give better yield than one. Redding (5) has shown that the nearer the area allotted to each plant approaches a square the greater its yield will be comparatively. Probably maximum yields are to be secured from one plant in a hill, but the difficulty of cultivation when the plants are spaced closely enough for best yields, makes this type of spacing impracticable.

SPACING FOR DIFFERENT VARIETIES.

But very little work has been done to determine the difference between different varieties as regards spacing. Duggar (7) found that in Alabama, Welborn, a cluster variety, gave its maximum yield when spaced one foot in the drill, while Peeler, a spreading variety, gave its best yield when the plants stood two feet apart. Four-foot rows were used in both cases.

In work carried on by Walker [illegible] at the Mississippi Delta Experiment Station Trice, a dwarfish variety, gave its [illegible] yield when spaced at six inches, while Lone Star and Columbia, larger growing varieties, with heavy foliage, yielded best twelve and eighteen inches, respectively. Results by Pittuck (4) of Texas, and othe

show no consistent differences. It stands to reason, however, that a vigorous, rank growing variety will be able to use to an advantage more space than a weaker, smaller growing variety. In case of varieties with heavy foliage, crowding the plants may result in much boll rot during rainy seasons. The dense shade produced is favorable for fungus growth on the bolls.

PLANTING IN CHECK ROWS.

In some cases where labor is scarce, or land very foul with coco grass or some other troublesome grass or weed, it may be economical to check row cotton—that is, plant in hills so spaced that the cotton can be plowed both ways. If planted in this way, the hills and rows should not be farther apart than thirty-six inches, and three or four plants should be left in the hill. The yields that will be obtained from cotton spaced in this way will not be so great, probably, as from well cultivated drilled cotton, but it will be better than that secured from "grassy" drilled cotton, and much less hand labor will be necessary. Ayres (10) reports very satisfactory yields from checked cotton at Scotts, Arkansas. Fox (24) secured good results from checked cotton at the Mississippi Delta Branch Station in 1907.

EFFECT OF TIME OF THINNING ON YIELD OF COTTON.

SINGLE STALK COTTON CULTURE.

About 1913 O. F. Cook and others, of the Office of Crop Acclimatization, United States Department of Agriculture, began advocating what they termed a "New System of Cotton Culture", or "Single Stalk Cotton Culture". The essential feature of the system was the suppression of vegetative branches by delayed thinning. When plants are allowed to crowd each other in the drill for a time, the development of vegetative branches is prevented to some extent. It has been claimed by the advocates of the system that the late thinning fosters the growth of the fruiting branches on the lower part of the plants, that the plants are induced to fruit earlier, and that the crop yield is larger because more early plants can be grown on the same area.

Most people who have made a study of the growth habits of cotton plants realize that crowding in the row will lessen the number of vegetative branches very greatly. This fact has been very well established by experimental evidence, but it has not been proved that the crowding will serve in any way to foster the developmnt of fruiting branches. On the other hand, the crowding in the early stages of growth, where delayed thinning is practiced, is very apt to affect the growth of fruit branches as well as vegetative. As a result of the early crowding the plants tend to become whip-like without any branches at all.

In an experiment mentioned by Cook (19), carried on at Norfolk, Virginia, in 1912, seven rows of Durango cotton were thinned early and plants left the usual distance (the exact distance is not given, but presumably the spacing was wide). Seven other rows were thinned late and the plants left close together, about three times as many plants being left as in the case of the wide spaced rows. The two sets of rows alternated. The closer spaced rows yielded at a rate of 1391 pounds of seed cotton per acre, while the wide spaced yielded at the rate of 909 pounds, the close spaced making fifty-three per cent more. With thick and thin rows alternating in this way the thick had the advantage and each row yielded more than it would if all the rows in the block had been close spaced. There was nothing in the experiment to show that if both sets of rows had been thinned earlier the yield of the closer spaced rows would not have been even greater. In other words, it was

not proved that the increase in yield was due to the late thinning rather than to the closer spacing.

In a similar but more extensive experiment conducted by Meade (20) at San Antonio, Texas, in 1915, very similar results were obtained. The late thinned rows were spaced six to eight inches and thinned June 2, while the early thinned were spaced 18 to 24 inches and thinned May 6. The close spaced rows produced more than 75 per cent as many flowers, more than 50 per cent as many bolls, and led in total yield by 56 per cent. But in this experiment, as in the other just mentioned, there is no evidence to show that the gain in yield was due in any way to the late thinning rather than to the close spacing.

Cardon (21) in twenty-one co-operative experiments, carried on in Louisiana, Arkansas and North Carolina, in 1915, secured much the same results as Meade, although the margin in favor of the late thinned cotton was considerably less. In three of the experiments the early thinning gave best yields. This experiment is subject to the same criticism as the other two just mentioned, that is, it contained nothing to show that the gain in yield was influenced by the delayed thinning.

SINGLE STALK COTTON CULTURE BY STATE EXPERIMENT STATIONS.

McClelland (22) reported results of single stalk cotton culture carried on in Georgia in 1914, 1916, 1917 and 1918. These tests were made in accordance with the plans outlined by Cook, except that only about twice as many plants were left in the late thinned as in the early thinned rows. As is shown by the following table, the early thinned rows led in yield in four of the five tests.

EARLY VERSUS LATE THINNING OF COTTON IN GEORGIA.

Thinning Date	1914 Durango	1916 Sunbeam	1917 Lewis 63	1917 Sunbeam	1918 Sunbeam	Average
Early	766	1850	1390	1585	1109	1340
Late	638	1878	1265	1521	1041	1248

Ayres (9) and (10) in cotton culture experiments in Arkansas in 1917 and 1918 secured better yields from the early thinned rows as compared with the late thinned rows in three tests out of four. The early and late thinned rows were thinned to the same distance in the drill.

EARLY VERSUS LATE THINNING. ARKANSAS.

		Pounds of Seed Cotton Per Acre.				
		1917.		1918.		
Inches in Drill.	When Thinned	First Picking	Total	First Picking	Total	Av. Total 2 years
6	Late	367	1290	639	1032	1161.0
6	Early	494	1495	619	981	1238.0
12	Late	406	1422	606	937	1179.5
12	Early	476	1500	696	1103	1301.5

SINGLE STALK COTTON CULTURE WORK AT THE MISSISSIPPI EXPERIMENT STATION.

In 1916 the Mississippi Experiment Station began some work to test the value of the Single Stalk Cotton Culture System. Thirty-two plots of Trice cotton were planted on moderately fertile valley soil on April 17. The plants in alternate plots were thinned to 8 to 12 inches in the drill, May 20. The plants in the remaining plots

grew undisturbed until June 7, when all except those designated in the table as "not thinned", were thinned to 6 inches in the drill. Boll weevils injured the cotton seriously, consequently the yields were low. The following table gives the main results from the test.

AVERAGES FROM SINGLE STALK COTTON CULTURE EXPERIMENTS.

MIISSISSIPPI, 1916.

Rows	Average No.. of plants per row	Average vegetative branches per plant	Average No. flowers per row	Average yield seed cotton per row in pounds
Wide Spaced	54.9	1.68	539	1.86
Single Stalk	95.6	.99	647	2.22
Not Thinned	158.6	.32	559	1.90

This test was made in accordance with Cook's plan (9) and results secured agree with his results. Here, as in the case of experiments made by Cook and by others of the Bureau of Plant Industry, the late thinned rows were given closer spacing than the early thinned ones, and greater yields were to be expected, due to this.

1917 EXPERIMENTS.

The 1917 experiments were planned to determine, whether or not, the increased yields secured by the delayed thinning in the late thinned plots in 1916 were due to the time of thinning or to the spacing used.

Sixteen 5-row plots were planted with Express seed. An excellent stand was secured. Half of the plots were thinned at the regular time in May, while the others were not thinned until June 7, which was about 17 days after the first plots were thinned. Both series of plots were thinned to 6 inches in the drill. All the rows in the plots were thinned alike, but only the 3 middle rows were used in getting data, weights, number of flowers produced, etc.

Both sets of plots were flowering on the same date. Counts were made on half the plots of each kind. On June 28, the first day a count was made, the regular thinned rows had 8 blossoms, while the late thinned ones had 7. Counting was continued until July 21. At that time the regular thinned rows had produced 3833 blossoms, while corresponding rows in the other plots had produced 3659 blossoms.

The rows thinned at the regular time yielded 933.7 pounds of seed cotton per acre, while the ones thinned late yielded 860.1 pounds, a difference of 73.6 pounds in favor of the early thinning. This seemed to indicate that it is the close spacing feature of the Single Stalk Culture system that is instrumental in producing better yields, rather than the late thinning. At least, such appeared to be the case under conditions prevailing when this test was conducted.

1918 EXPERIMENTS.

Wannamaker-Cleveland cotton was used in 1918. It was planted April 26 and an excellent stand secured. Both series of plots were thinned to a "hoe's width", or approximately 10 inches in the drill. The early thinning was done May 16. The plants were then small. The first leaves had just appeared. The late thinning was done June 10. The plants were then about 10 inches tall and the crowding effect had made them somewhat taller than the plants in the other rows.

The following table gives certain data on the experiment in 1918. The whole plot contained 38 rows; these were grouped in 8 sub-plots, containing 4 or 5 rows each.

The weights of only the 3 middle rows of the 5-row plots and the 2 middle rows of the 4-row plots were used in comparison. The weights from these rows averaged 10.9 pounds for the early thinned, and 8.5 pounds for the late thinned. The number of plants in the 2 sets of rows averaged practically the same—105.3 in one case and 103.6 in the other. The early thinned rows were more spreading and looked more stocky and vigorous during most of the season. A count of the vegetative branches showed that they had an average of 255.3 to the row, while the others had 198.2. There was considerable difference, too, in the height of the origin of the lowest vegetative branches. The average distance from the ground to the first branch for the early thinned rows was 4.8 inches, and 7.6 inches for the others.

On July 1, just a few days after blooming began, 63 blossoms were counted on the early thinned rows and only 24 on the others. This seemed to indicate that the early thinned rows were fruiting a little earlier.

The early thinned rows had on September 1, an average of 4.51 open bolls per plant. while the late thinned rows had 2.79.

1919 EXPERIMENTS.

Single Stalk Culture Experiments were continued in 1919 following plans outlined above. Trice Cotton was used and an excellent stand secured. The delayed or late thinned plots were thinned June 17 and the regular thinned June 4. Both sets of plots were thinned to a "hoe's width", the closest spacing that can be used conveniently.

	1918			1919		
	Seed Cotton per row	Plants per row	Vegetative Branches per row	Seed Cotton per row	Bloom Count Aug 6	Bloom Count Aug 7
1. Delayed Thinning	9.5	.....	.....	8.0	.....	.....
2. Delayed Thinning	10.	107	192	6.75	17	43
3. Delayed Thinning	10.	118	212	6.75	23	37
4. Delayed Thinning	11.	122	224	7.5	30	42
5. Delayed Thinning	12.	.....	.....	6.25	.....	.....
6. Delayed Thinning	.. ..	.....	.....	5.5	.....	.....
7. Regular Thinning	12.5	.....	.....	8.	.....	.....
8. Regular Thinning	10.5	102	258	8.25	43	74
9. Regular Thinning	12.5	112	252	7.	26	61
10. Regular Thinning	12.5	118	248	7.25	18	58
11. Regular Thinning	9.5	.....	.....	7.5	.....	.....
12. Regular Thinning	.. ..	.....	.....	7.5	.....	.....
13. Delayed Thinning	10.5	.....	.....	4.75	.....	.....
14. Delayed Thinning	8.5	98	192	5.5	22	46
15. Delayed Thinning	8.	98	202	4.	13	28
16. Delayed Thinning	10.5	104	194	5.	24	35
17. Delayed Thinning	10.	.....	.....	6.5	.....	.....
18. Delayed Thinning	.. ..	.....	.....	5.5	.....	.....
19. Regular Thinning	12.	.....	.....	7.25	.....	.....
20. Regular Thinning	13.	114	260	7.75	27	53
21. Regular Thinning	10.	112	276	7.5	30	72
22. Regular Thinning	10.5	106	243	8.25	26	46
23. Regular Thinning	10.5	.....	.....	8.5	.....	.....
24. Regular Thinning	.. ..	.....	.....	9.25	.....	.....
25. Delayed Thinning	10.5	.....	.....	6.	.....	.....
26. Delayed Thinning	10.	98	197	6.	21	43
27. Delayed Thinning	7.5	94	182	4.	17	19
28. Delayed Thinning	7.5	100	189	4.5	25	28
29. Delayed Thinning	8.5	.....	.....	4.	.....	.....
30. Delayed Thinning	.. ..	.....	.....	4.5	.....	.....
31. Regular Thinning	.. ..	.....	.....	6.25	.....	.....
32. Regular Thinning	12.	102	265	7.	26	62
33. Regular Thinning	11.	102	264	6.5	18	59
34. Regular Thinning	11.	90	232	7.5	25	66
35. Regular Thinning	10	.....	.....	7.75	.....	.....
36. Regular Thinning	.. ..	.....	.....	7.	.....	.....
37. Delayed Thinning	6.5	.....	.....	.. ..	.....	.....
38. Delayed Thinning	6.	103	.....	.. ..	.....	.....
39. Delayed Thinning	5.	97	.....	.. ..	.....	.....
40. Delayed Thinning	6.	.....	.....	.. ..	.....	.....
41. Regular Thinning	9.5	.....	.....	.. ..	.....	.....
42. Regular Thinning	8.5	98	.....	.. ..	.....	.....
43. Regular Thinning	8.5	102	.....	.. ..	.....	.....
44. Regular Thinning	6.5	.....	.....	.. ..	.....	.....
45.	.. ..	.....	.....	.. ..	.....	.....
46. Averages	.. ..	.....	.....	.. ..	.....	.....
47. Delayed Thinning	8.5	103.6	198.2	5.5625	21.3	35.6
48. Regular Thinning	10.9	105.3	255.3	7.5625	26.5	61.2

As will be seen from the accompanying table, the rows thinned early or at the regular time gave the best yields, averaging just 2 pounds more per row than the other rows. These results are in accord with results obtained in other years, when both sets of rows were given the same spacing.

Delayed thinning experiments conducted by Ayres at the Delta Branch Experiment Station in 1922 showed a yield of 736 pounds of seed cotton per acre for cotton thinned at the regular time, and 556 pounds per acre for the late thinned. The cotton in both plots was spaced the same. The late thinning was done when plants were 10 to 12 inches high.

CONCLUSIONS IN REGARD TO SINGLE STALK CULTURE.

Since there seems to be no experimental evidence to show that increased yields are to be secured through delayed thinning, and since there is evidence from three different experiment stations to show that late thinning most frequently results in lower yields, it seems that the Single Stalk Method of Cotton Culture is of very doubtful value. We believe that cotton plants should be thinned as early as it is safe to do so—that is, as soon as the danger of losing a stand from cold weather, damping off fungi, etc., has passed, and before the plants are stunted by undue crowding.

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INDEXED
Division of Horticulture Catalog

Report From Raymond Branch Experiment Station

For 1920 to 1922 Inclusive

C. B. ANDERS

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
AGRICULTURAL COLLEGE, MISSISSIPPI
J. R. Ricks, Director

Report of The Work at The Raymond Branch Experiment Station

By C. B. Anders

INTRODUCTION

The Raymond Branch Experiment Station was established by the Legislature of 1920 and located at Raymond, Mississippi. During the year 1920 a location was selected, land purchased and some buildings and improvements begun. Complete possession of the farm was not obtained until January, 1921, and farming operations did not begin until that date.

The Station adjoins the farm of the Hinds County Agricultural High School and Junior College. It is one mile from Raymond and sixteen miles from Jackson on the Raymond-Jackson Highway. It consists of one hundred sixty-nine acres of hill and valley land of Brown-loam type, fifty acres of which was purchased by the state, eighty acres donated by Hinds County and thirty-nine acres donated by Hinds County Agricultural High School.

The author fully realizes that all experiments must be run through a series of seasons before definite conclusions can be drawn and for this reason data on many of the projects under way here is not published in this bulletin.

IMPROVEMENTS

The farm as originally purchased was entirely without improvements. There was no barns, buildings or fences; the hills were badly washed, the valleys had little drainage and many parts of the place had been allowed to grow up to bushes, briars and willows. These conditions have made it necessary for a great part of the first two years to be devoted to building, fencing, ditching, terracing and clearing land. This and the lack of sufficient funds have limited experimental work. At the present writing a residence for the Assistant Director has been completed, an old cottage repaired for the Farm Foreman, a barn and an implement shed built, and an efficient system of ditches and terraces put in over a large part of the farm. Most of the land has been cleared and a hog proof fence put around the place.

COTTON

VARIETY TESTS—These tests are conducted for the purpose of comparing the leading commercial varieties and testing new varieties and selections that are put on the market. A wide variation in yields and in money value of different varieties indicates the great need of carefully selected seed adapted to the section in which they are grown.

Results of two years' variety work here are shown in table number 1. Both these tests were conducted on valley land typical of the bot-

tom lands in this section and fertilized with 200 pounds acid phosphate and 100 pounds nitrate of soda per acre.

TABLE I. COTTON VARIETY TESTS—1921-1922

Variety	Yield of Seed Cotton Per Acre		Lint Per cent		Length of Lint		Value of Lint per Lb in Cts		Total Money Value of Seed and Lint		Rank in Mon Value	
	1921	1922	1921	1922	1921	1922	'21	'22	1921	1922	'21	'22
Simpkins	911	1219	39.1	33.5	½	¾	12	23.25	53.89	107.04	23	18
Bank-Account	963		35.9		½		12		53.73		24	
Miss. Station Trice	947	1420	32.2	31.3	1 1/16	1 1/16	21	25.00	76.89	125.68	12	4
Wanna'mkr-Clev'ld	907	1193	38.2	37.4	⅝	⅞	14	23.75	59.79	117.99	18	11
Cleveland-54	1027	1307	37.2	35.2	⅝	15-16	13	24.00	62.56	122.99	17	5
Piedmont-Cleveland	1019	1270	36.7	35.3	½	15-16	12	24.00	57.74	119.94	20	8
Cleveland Big Boll	907		36.7		⅝		14		58.14		19	
Cook-1010	884		42.1		½		12		54.91		22	
Cook-588		983		36.7		⅞		23.75		94.95		22
Half and Half	987	1115	46.1	43.6	½	⅞	13	22.75	69.76	120.13	14	7
Miller	1031	957	35.3	32.6	1 1/16	1 1/16	22	25.00	93.36	87.60	6	23
Triumph	904		38.8		⅞		16		68.16		16	
Lone Star	756		37.8		⅞		16		55.09		21	
Lone Star 65	999	1217	34.6	32.9	1 3/16	1 ⅛	27	26.50	100.43	118.43	1	10
Lone Star-79		1233		30.9		1 ⅛-3/16		27.00		115.67		13
Acala Number 5	1079	1032	37.9	35.3	1	1 1/16-⅛	16	25.25	78.85	101.85	11	21
Salsbury	987	1160	34.2	33.4	⅞	1 ⅛	16½	26.50	68.71	114.06	15	14
Express-432	967		33.6		1 ⅛		23		87.64		8	
Express-782	931	1262	32.4	32.7	1 3/16	1 3/16-¼	24	28.00	85.07	120.07	9	3
Express 122-433	963		29.8		1 3/16		24		82.39		10	
Express 350-718	1035		29.8		1 3/16		25		91.44		7	
Express, Walcot		1283		29.8		1 3/16		27.50		118.56		9
Express Lightning		1285		28.3		1 3/16		27.50		113.97		15
Express-630		1338		28.8		1 3/16		27.50		120.44		6
Express-350		1229		27.5		1 3/16		27.50		106.32		19
Delfos-6102	1039	1440	33.4	31.6	1 ⅛	1 1/16	26	27.50	104.06	139.76	2	1
Delfos-631	1019	1185	33.5	31.5	1 ¼	1 3/16-¼	26	28.00	102.17	116.67	3	12
Delfos-698		1400		32.6		1 3/16		27.50		139.68		2
Sunpress-61	947	1221	27.5	27.1	1 ¼	1 1/16	32	29.50	97.14	111.01	4	16
Webber-49-4	760	1076	30.1	29.8	1 ¼	1 ¼	28	28.50	74.67	102.61	13	20
Delta-Type Webber	935	1105	31.2	30.4	1 ¼	1 ¼	28	28.50	94.68	107.40	5	17

FERTILIZER TESTS—Tables number 2 and 3 give results from two fertilizer tests. Test number 1 has run two years on the same plats, number 2 one year on an adjoining piece of ground with the order of plats reversed. In these tests the increase in yields where stable manure was used is outstanding. The best yields and increases were obtained with the use of 5 tons stable manure and 200 pounds acid phosphate per acre. Nitrate of soda and cotton seed meal gave good returns. Acid phosphate used without nitrate in some form did very poorly. Second to the stable manure the most economical results were obtained from the use of 200 pounds of acid phosphate and 100 pounds nitrate of soda. This combination is advised as a safe fertilizer for this section. In some instances potash seems to have given profitable returns but at present the writer does not feel justified in advising its use except on soils where rust attacks the cotton.

TABLE II. COTTON FERTILIZER TEST NO. 1—1921-1922

Plat No.	Fertilier Applied Amount Per Acre	Yields in Pounds Seed Cotton Per Acre			
		Yield 1921	Incr. Over Check 1921	Yeild 1922	Increase over Check 1922
1	5 Tons Stable Manure	1584	627	1204.3	549.5
2	Check	957		654.8	
3	200 lbs. Nitrate Soda	1122	165	745.5	90.7
4	400 lbs. Cotton Seed Meal	1083	288	983.8	416.3
5	Check	795		567.5	
6	400 lbs. Acid Phosphate	717	Loss 78	537.3	Loss 30.2
7	200 lbs. Kainit	735	40	384.9	32.6
8	Check	695		352.3	
9	100 lbs. Ni. Soda, 200 lbs. A. P.	816	121	587.6	235.3
10	200 lbs. C. M., 200 lbs. A. P.	693	65	592.1	292.9
11	Check	528		299.2	
12	100 lbs. N. Sod., 100 lbs. Kainit	1020	492	506.9	207.7
13	200 lbs. C. M., 100 lbs. Kainit	1275	354	632.5	212.8
14	Check	921		419.7	
15	200 lbs. C. M., 200 lbs. A. P. 100 lbs. Kainit	1021	100	656.1	236.4
16	200 lbs. C. M., 200 lbs. A. P. 200 lbs. Kainit	1194	240	747.5	164.3
17	Check	954		583.2	
18	5 tons Stab. Man., 200 lbs. A. P.	1746	792	1407.6	824.4
19	5 tons Stab. Man., 100 lbs Kain	1692	654	1380.0	813.2
20	Check	1038		566.8	
21	5 tons Stable Manure 200 lbs. A. P., 100 lbs. Kainit	1443	405	1231.8	665.0

TABLE III. COTTON FERTILIZER TEST NO. 2—1922

Plat No.	Fertilizer Applied Amount per Acre	Yields in Pounds Seed Cotton Per Acre	
		Yield	Increase over Check
1	100 lbs. Ni. Sod., 200 lbs. Ac. Phos.	802.3	166.6
2	Check	635.7	
3	200 lbs. C. M., 200 lbs. Ac. Phos.	701.5	65.8
4	100 lbs. Ni. Soda, 100 lbs. Kainit	684.0	266.8
5	Check	417.2	
6	200 lbs. C. M., 100 lbs. Kainit	542.2	125.0
7	200 lbs. C. M., 200 lbs. Ac. Phos. 100 lbs. Kainit	790.0	238.2
8	Check	551.8	
9	200 lbs. C. S. Meal, 200 lbs. Ac. Phos. 200 lbs. Kainit	801.8	249.7
10	5 Tons Stable Manure, 200 lbs. Ac. Phos.	1346.7	562.7
11	Check	784.0	
12	5 Tons Stable Manure, 100 lbs. Kainit	1305.1	521.1
13	5 Tons Stable Manure, 200 lbs. Ac. Phos. 100 lbs. Kainit	1314.6	477.0
14	Check	837.6	
15	5 Tons Stable Manure	1254.3	416.7
16	200 lbs. Nitrate Soda	816.7	233.8
17	Check	682.9	
18	400 lbs. Cottonseed Meal	706.2	23.3
19	400 lbs. Acid Phosphate	759.6	49.0
20	Check	710.6	
21	200 lbs. Kainit	419.1	Loss 291.5

MISCELLANEOUS COTTON TESTS—In a test of regular cultivation versus alternately cultivating middles no increase in yield was obtained.

Tests are under way studying both time and method of applying fertilizer on which sufficient data for publication has not been obtained.

Records are being made on rotations using crimson clover, bur clover and vetch with corn and cotton. At present the clovers are growing nicely following cotton.

No spacing tests have been conducted on this station but the writer feels that attention should be directed to bulletin number 212 of the Mississippi Experiment Station dealing with this subject in detail. The many tests summarized show conclusively that close spacing is essential.

CORN

VARIETIES—Table nubmer 4 summarizes results from two years' variety tests on valley land without any fertilization. A study of this table will show a marked variation in both yields and quality of the different varieties.

TABLE IV. CORN VARIETY TESTS—1921-1922

	Variety	Total Bu Gr. per A		Bu. No 1 Gr. Per A.		Bu. No. 11 Gr. per A		Tot'l Money Value per A		Rank in Mon. Val	
		1921	1922	1921	1922	1921	1922	1921	1922	'21	'22
1	Williamson	27.5	31.71	23.4	20.08	3.5	10.32	19.30	20.22	12	2
2	Biggs 7-Year	29.4	27.41	24.4	9.43	4.4	17.54	20.50	15.84	7	14
3	Whatley	28.1	29.33	25.3	23.73	2.6	5.60	20.27	20.60	10	1
4	Mosby-College	30.2	25.94	28.4	12.89	1.7	12.68	22.15	16.01	2	12
5	Mosby-Delta		27.86		12.75		14.59		16.86		8
6	Mosby-Ewing	30.5	29.63	26.8	17.25	3.4	11.92	21.80	18.90	3	4
7	Cocke-College	28.8	26.68	25.3	14.29	3.0	12.09	20.47	16.77	8	9
8	Cocke-Delta	29.2	28.24	26.0	11.20	3.0	14.45	21.00	15.63	6	15
9	Hastings Pro.	29.5	23.44	25.7	12.09	3.6	11.06	21.07	14.60	5	18
10	Vardaman		26.09		12.68		12.82		15.92		13
11	Marlboro	25.6	28.66	22.5	17.77	2.7	10.25	18.22	18.46	15	5
12	Leguna	29.5	35.82	26.5	12.97	2.8	15.69	21.27	17.58	4	6
13	Mexican June		25.42		12.65		12.06		15.52		16
14	Tenn. Red Cob	26.5	19.84	21.1	4.15	5.0	14.92	18.32	10,57	19	14
15	Paymaster	30.7	28.40	21.9	8.95	7.7	18.68	20.27	16.05	11	11
16	Ellis	35.6	29.70	32.2	20.88	3.0	7.91	25.65	19.62	1	3
17	U. S. No. 201		27.76		12.75		14.40		16.76		10
18	Florida Flint	29.0	26.59	24.3	8.69	4.3	17.25	20.37	15.15	9	17
19	N. C. Prolific	25.3	27.50	20.0	12.76	4.9	15.05	17.45	17.10	16	7
20	Reid's Yel. Dent	28.0	17.81	10.6	2.33	8.4	3.24	12.15	3.37	20	20
21	Calh'n Red Cob	22.9		20.0		2.7		16.35		18	
22	Payms'tr (Harp)	28.0		19.4		7.9		18.50		13	
23	Tenn. R. C.-72	20.4		14.6		4.6		13.50		19	
24	Chisholm	25.5		17.6		6.8		16.60		17	

MISCELLANEOUS TESTS—Crimson clover following corn and plowed under increased the yield of corn ten per cent the first year. In

this test crimson clover made excellent growth on all but the very thinnest soil.

Rotation and fertilizer tests are under way on which data is not yet ready for publication, however we obtained increases of from ten to twenty bushels of corn per acre on the very poorest hill land by the use of 200 pounds acid phosphate and 200 pounds nitrate of soda per acre.

TOMATOES

VARIETIES—Table number 5 shows results with two years variety tests conducted on valley land. Tomatoes in these tests were grown and graded according to commercial standards and results apply to the commercial grower rather than to the gardener.

TABLE V. TOMATO VARIETY TESTS—1921-1922

No.	Variety	Yields in Pounds		Average Size in Pounds		Per cent of Firsts		Per cent of Seconds	
		1921	1922	1921	1922	1921	1922	1921	1922
1	Dwarf Champion	40		.18		33		51	
2	Livingston's Globe	35.9	59.3	.19	.20	49	52	42	27
3	Early Detroit	41.5	82.5	.23	18	59	54	28	24
4	Livingston"s Beauty	59.2	28.33	.25	18	75	38	17	22
5	Red Field Beauty	51.2		.23		43		44	
6	Livingston's Man'ld	90.7		.16		62		36	
7	Matchless	77.4	70.6	.24	19	65	47	27	30
8	Ponderosa	32.8		.39		27		47	
9	Acme	49.6		.23		50		42	
10	Red Rock	61.6	63.9	.25	.20	34	44	59	28
11	Improved Stone	75.5	38.83	.24	.18	53	48	39	26
12	Gulf States		74.90		.18		56		23

FERTILIZERS—Table number 6 gives the results of one years' work with varying proportions of potash. These tests are to be continued until the need of potash for commercial truck crops has been definitely determined for this section. In this table an 8-4-3 fertilizer means one containing 8 per cent phosphorous, 4 per cent nitrogen, and 3 per cent potash.

TABLE VI. TOMATO FERTILIZER TESTS—1922

Plat No.	Fertilizer Used 1200 Lbs.	Yield Total	Yield of Grade Lbs			Average size of		Per cent of			Earliness percent pulled 1st 4 pickings
			1sts	2nds	Culls	1sts	2nds	1sts	2nds	Culls	
1	8-4-0	81.8	13.5	18.5	49.9	.21	.16	16.5	22.6	61.0	10.4
2	8-4-3	73.5	12.0	13.96	47.5	.26	.19	16.3	19.0	64.7	4.8
3	8-4-6	85.0	9.3	15.6	60.1	.22	.17	11.0	18.4	70.7	5.7
4	4-4-0	80.7	18.9	23.8	37.9	.27	.20	23.4	29.6	47.0	5.9
5	4-4-3	72.8	17.1	17.7	38.0	.28	.21	23.5	24.3	52.2	4.6
6	4-4-6	73.7	17.2	22.5	34.0	.28	.20	23.3	30.5	46.1	1.6

MISCELLANEOUS

In addition to the projects previously mentioned this station is doing work with various clovers, vetches, soy beans, peas and other for-

age crops, and an orchard of peaches, apples and grapes has been started. Additional work will be started this year on varieties and fertilizers for several commercial truck crops and the trucking work will be given special attention for the next few years.

Careful records on all work are being tabulated and these results will be published from time to time as soon as sufficient conclusive data is obtained.

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BULLETIN 214 JANUARY, 1923

Experiments with Feeding Steers Using Cottonseed Meal and Varying Proportions of Corn and Cottonseed Meal

By E. BARNETT and C. J. GOODELL

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. RICKS, Director

Cottonseed meal is the most valuable concentrate used for the finishing of beef cattle throughout the greater part of Mississippi. By many of our feeders, it is depended upon as the sole concentrate for fattening steers for the market. Where fed in this manner with corn silage as roughage, cottonseed meal supplies more protein than is called for by ordinary feeding standards, and the use of some supplement high in carbohydrates is suggested as a means of reducing feed costs and, at the same time, producing a higher degree of finish than is secured where cottonseed meal is fed alone.

Among the feeds of a carbonaceous character corn is the most available. That corn has not been fed to a greater extent in Mississippi has been due to the farm price which, over a period of twenty years from 1901 to 1920, averaged almost fifty per cent higher than in some of the leading corn producing states. This limited its use in this section largely to the feeding of work stock and hogs. The acreage of corn in the state, however, for the ten years from 1911 to 1920 was greater by practically fifty per cent than for the preceding ten year period. As a result, during recent years, farm prices have been much nearer to those prevailing in the corn belt states, indicating an increasing availability of this feed to our farmers and cattle feeders.

The purpose of the feeding trials discussed in this bulletin was a comparison of cottonseed meal alone and with corn in varying proportions, fed with silage for fattening beef steers. The tables contained herein should assist the cattle feeder in selecting the most economical ration for fattening yearling and two year old steers under Mississippi conditons.

BULLETIN 214

Experiments with Feeding Steers Using Cottonseed Meal and Varying Proportions of Corn and Cottonseed Meal

By E. Barnett and C. J. Goodell*

CONCLUSIONS

I. Under the conditions of this experiment a pound of cottonseed meal was more valuable from an economic standpoint than a pound of corn, the difference in value being dependent upon the proportions in which the feeds were used, the relative values of the concentrates and roughages, and upon the spread in the market prices of well finished cattle and those carrying less finish.

II. Used with cottonseed meal and corn silage for fattening steers, small amounts of corn may be fed, without increasing the cost of gains, at higher prices than larger amounts.

III. As the prices of corn and cottonseed meal advance, the price of corn silage remaining constant, the difference in value between cottonseed meal and corn is widened. This is due to the utilization of larger amounts of silage where cottonseed meal is the sole concentrate, than where part of the concentrate portion of the ration consists of corn. In a ration of cottonseed meal, corn, and corn silage the consumption of corn silage varies inversely with the corn used in the ration.

IV. Whether or not corn can be profitably substituted for a part of the cottonseed meal in a ration of cottonseed meal and corn silage for fattening steers, and if so to what extent, is determined by the relative cost of these feeds, by the cost of corn silage and by spread between the market prices of well finshed cattle and those carrying less finish.

V. By the use of corn in connection with cottonseed meal for the fattening of steers, a higher finish can be obtained than where cottonseed meal is the sole concentrate. Improvement in finish will be more marked where corn is fed in amounts of from eight to twelve pounds daily per thousand pounds weight of steers than where fed in smaller amounts. This improvement in finish is reflected in the selling price of the steers and in the dressing percent. The spread in the market price of well finished cattle compared with those carrying less finish may determine whether or not it is profitable to use corn in the feeding of steers for the market.

VI. Where corn and cottonseed meal are fed in combination with corn silage more rapid gains may be expected than where cottonseed meal is fed alone.

VII. Where corn is fed to steers, hogs should be kept in the lots to utilize the undigested grain.

VIII. Where cottonseed meal is the sole concentrate fed, it is not practicable to put hogs after steers unless they receive some feed in addition to that secured from the droppings.

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*This work was undertaken by H. K. Gayle in 1916; continued by D. J. Griswold in 1919; and completed by the authors in 1921.

PURPOSE.

The questions most frequently asked concerning the fattening of beef cattle in Mississippi have to do with the use of corn; whether it can be profitably substituted for cottonseed meal; and, if so, in what proportions corn and cottonseed meal will prove most economical for finishing steers under Mississippi conditions. The purpose of the four years steer feeding trials herein reported was to secure data on the feeding of corn and cottonseed meal with corn silage for the fattening of beef steers.

PLAN.

The work was inaugurated in the fall of 1916 by H. K. Gayle, Experiment Station Animal Husbandman. That year, thirty-two steers were divided into four groups of eight each. With the exception of the ration fed, the purpose was to make all factors as nearly identical as possible.

During the first sixty days, the four lots of steers were fed the follownig average daily ration per thousand pounds of cattle, rations being calculated at the end of each thirty days:

Lot	I	II	III	IV
Cottonseed Meal	5.00	4.00	3.00	2.00
Broken Ear Corn		6.25	12.50	18.75
Corn Silage	ad libitum			

At the beginning of the second sub period of sixty days the cottonseed meal was increased one pound per thousand pound weight of cattle in each lot.

In the trials during the winter of 1918-19, the spring of 1920 and the winter of 1920-21, these same rations were used in the corresponding lots, except that in the 1920-21 work, lot IV was dropped from the experiment, due to economic conditions unfavorable to feeding for the higher finish obtained by the use of the larger amounts of corn.

For convenience in discussion the rations used in lots II, III, and IV are designated as "Light corn ration", "Medium corn ration", and "Heavy corn ration", respectively.

SHELTER, FEED LOTS, AND WATER SUPPLY

Each lot of cattle occupied similar quarters. The steers and hogs were sheltered by an open shed and had the run of open lots. Both concentrates and silage were fed in troughs about twenty-four inches wide, arranged along the feed alley at the back side of the shed. Water was supplied by the College power plant from deep wells, and watering troughs were accessible to each lot.

Except for cinders and shavings no bedding was used as the plan of the experiment limited the roughage consumed by the steers to corn silage, and it would have been impossible to have prevented the steers from eating part of the bedding had straw or old hay been used for that purpose*. The manure was hauled from the sheds at intervals during the feeding period. While the lots and sheds did not get in as bad condition as might have been expected, it is highly desirable, under farm conditions, that bedding be used to absorb the liquid manure and to keep the steers as comfortable as possible.

WEIGHTS

At the beginning and end of each trial, the steers were weighed individually three days in succession, the average of the three weights being used as the initial and final weights. Throughout the trials the cattle were weighed at intervals of twenty-eight or thirty days or at the conclusion of each subperiod. In the later trials the twenty-eight day sub-periods were used because of the convenience of weighing on the same day of the week each time. The identity of each steer was known either by a neck strap to which was attached a metal tag, or by individual brand. The steers were always weigh-

*Other feeding experiments indicate the desirability of using a small amount of dry roughage such as Johnson grass, hay or oat straw with corn silage for fattening steers.

ed at the same hour of the day and no change was made in water or feed preparatory to weighing.

METHOD OF FEEDING

The daily ration was divided into two equal feeds and the steers were fed at 6:30 a. m. and 4:30 p. m. The silage was first placed in the troughs and the concentrates were scattered over the silage†, and any feed remaining after two hours had elapsed from the time of feeding was removed and weighed. Salt was either kept before steers at all times or was supplied at regular intervals. The weighing of feeds and feeding was done by student help under the direction of the Station Animal Husbandman.

CATTLE.

All of the cattle used throughout these trials were two year olds of beef breeding and were either grown on the station farm or were purchased locally, except in 1918-19, when yearlings were secured on the St. Louis market. In each instance the cattle used were either naturally polled or had been dehorned for a long enough time prior to their being put on feed to be completely recovered from the effects of dehorning. In the matter of quality there was probably but little variation, the cattle at the beginning of the trials being graded each year as good to choice. Where the cattle used were bred by the Experiment Station, however, they were of a little better quality than those purchased either locally or at St. Louis.

FEEDS.

Cottonseed meal each year was purchased in the state, was of choice grade and was charged against the cattle at the cost price. The corn fed was grown on the station farm and was of the prolific varieties. It was charged to the cattle at the local market price*. Where tankage was fed to the hogs following the steers, it was charged at the cost price at the Experiment station.

In all trials in this experiment corn silage was used as the sole roughage and was produced on the Experiment Station farm in a field near the feed lots. To assist in maintaining the fertility of this field, it was seeded to crimson clover each year as soon as possible after the silage was removed. The crimson clover was turned under about the first of April and the corn planted about June first. Goliad corn was used because of the tonnage which it produces. The price at which silage was charged in each of the trials was influenced by the local price of corn and by labor costs.

HOGS.

During the winters of 1916-17 and 1918-19, hogs were used to follow the steers in each lot at the rate of one hog per steer. In 1916-17 two bunches of hogs were used. The first bunch followed the steers for the first ninety days of the trial and the second bunch for the remainder of the feeding period. A small pen containing a self feeder for the hogs was placed in each lot. The first year the self feeder was kept filled with shelled corn and cottonseed meal in separate compartments and the hogs were given access to it for a limited time each evening, after having followed the steers all day. In the winter of 1918-19, this same arrangement was used but tankage was supplied in the self feeder instead of cottonseed meal.

In the trials in the spring of 1920 and the winter of 1920-21 the hogs received no feed other than that secured from the droppings of the steers.

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†While no difficulty was recorded as a result of this method of feeding it is preferable to thoroughly mix the concentrates with the silage to prevent any one steer that might be overly greedy from getting too large a portion.

*In the first two trials and part of the third, broken ear corn was used. On account of the greater convenience in weighing, shelled corn was used in the latter part of the third trial and in the last. In all calculations herein, 70 pounds of ear corn and 56 pounds of shelled corn were used per bushel. Under farm conditions, experimental data indicates that it does not pay to shell corn for fattening steers.

METHOD OF STARTING CATTLE ON FEED

The methods of starting the cattle on feed were very similar in each of the four trials. The one described here, however, is only approximate. The steers in lot I were started on an average daily ration of about two pounds of cottonseed meal which was raised at the rate of a pound a week until the cattle received five pounds of cottonseed meal daily per thousand pounds live weight. At the end of sixty days, the average daily ration was raised to six pounds of cottonseed meal daily per thousand pounds and by the end of the period to about eight pounds. Lots II, III and IV were started on a smaller average daily feed of cottonseed meal and were increased gradually until they received the amounts called for in their respective rations. In addition to the cottonseed meal received, the steers in lot IV were started on four pounds of corn per thousand pounds weight and were gradually increased until they received 18.75 pounds of corn daily per thousand pounds. Lots II and III were started on smaller average daily feeds of corn and were increased gradually until they were receiving the amounts of corn designated respectively in their rations. To all lots as much corn silage was fed as the cattle would eat up clean.

MARKETING.

Preparatory to shipment the cattle were handled in the ordinary way, no change being made either in regard to feed or water. The car was ordered through the local freight agent several days in advance of the date on which it was needed. Before the cattle were loaded the car was carefully examined to see that there were no holes in the floor and that it was otherwise in good condition. If the car provided was not already bedded, old hay or straw was used for that purpose. The cattle were driven a distance of about a mile and a quarter to the loading chutes. They were handled as quietly as possible enroute and on arrival, were allowed to rest and cool for about a half hour before loading, the general practice being to load within twenty or thirty minutes of the departure of the train. Leaving Starkville at seven A. M., the cattle usually arrived at the yards about ten a. m. the following day. They were consigned to one of the commission firms on the St. Louis market, arrangements being made to have each lot sold separately. To assist in the securing of an accurate appraisement of each separate lot a representative of the Experiment Station accompanied the cattle to market, but all details of the sale and handling of the cattle were left entirely with the commission firm to whom they were consigned. In each case the packing firm handling the cattle gladly furnished the dressing percentages for the individual lots.

FEEDING TRIALS WITH COTTONSEED MEAL AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING TWO-YEAR OLD STEERS, WINTER 1916-17.

According to the original plan the cattle this year were to be fed for a period of one hundred and eighty days, using three sub-periods of sixty days each. Due to the spoiling of the silage in one of the silos, it was necessary to terminate the feeding at the end of the second sub-period, giving a total feeding period of one hundred and twenty days. As it was impossible to secure a car immediately upon the conclusion of the trial, the cattle were held for twelve days longer, waste hay being substituted during that time for part of the silage in the ration.*

*For this twelve day period, the average daily gain per steer in lots I, III, and IV were .8 pounds, .9 pounds, and 2.8 pounds respectively. Lot II showed an average daily loss per steer of .66 pounds. In a general way this supports the statement made by Professor E. S. Good in Circular 75 of the Kentucky College of Agriculture as follows: "The number of cattle fed should be determined by the amount of silage on hand. Cattle should be sold before the silage is exhausted for when they are deprived of succulent feed to which they have been accustomed, they usually shrink." The percent of shrink enroute to market was based on the final home weight. The shrink shown in the summary of this year's work was calculated by using the percent of shrink thus obtained and the weights of the cattle at the conclusion of the trials.

The rations fed were those given in the general plan of the experiment. Hogs were used to follow the steers in each lot at the rate of one hog per steer. Two bunches of hogs were used, the first bunch following the steers for the first ninety days and the second bunch for the remainder of the feeding period. A small pen containing a self feeder, which was kept filled with corn and cottonseed meal in separate compartments, was placed in each lot. The hogs were given access to these feeders for about two hours each evening after having followed the steers all day. The hogs used were well bred and averaged 88.1 pounds when placed in the feed lot.

CATTLE.

The steers used were bought locally, costing $7.00 per hundred weight. They were a mixed lot of Angus, Hereford and Shorthorn grades and would have been classed on the market good to choice feeders. At the time of starting on feed, they were in rather thin condition, averaging 858.6 pounds in weight.

FEEDS.

Cottonseed meal was bought and charged to the steers at $37.50 per ton. Corn was charged at $1.00 per bushel the average market price locally during the period of the trial. Silage was valued at $4.00 per ton.

TABLE I. AVERAGE DAILY RATION BY SUB-PERIODS—1916-17

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration	LOT III C.S.M. Silage Medium Corn Ration	LOT IV C.S.M. Silage Heavy Corn Ration
First Sub-Period (62 days)				
Cottonseed meal (lbs.)	4.71	3.65	2.86	1.82
Broken ear corn (lbs.)		5.69	11.52	17.08
Corn silage (lbs.)	69.17	59.57	50.44	39.41
Second Sub-Period (58 days)				
Cottonseed meal (lbs.)	6.25	5.37	4.34	3.00
Broken ear corn (lbs.)		6.96	13.37	21.40
Corn silage (lbs.)	70.38	42.67	51.00	41.00
Av. Daily Ration for entire Period (120 days)				
Cottonseed meal (lbs.)	5.46	4.49	3.58	2.39
Broken ear corn (lbs.)		6.31	12.42	19.17
Corn silage (lbs.)	69.76	51.41	50.72	40.06

The amount of corn silage consumed by the steers in the different lots varied inversely with the corn fed. The total dry matter in the ration was smallest in lot II receiving the least amount of corn, and was greatest in lot IV receiving the largest amount. Due to the comparatively light consumption of silage by the steers in lot II during the second half of the trial, the total dry matter in the ration in lot II was slightly less than in lot I receiving no corn. The amount of digestible nutrients in the ration was smallest in lot I and greatest in lot IV, increasing with the increased percentage of corn. In the average daily rations consumed by the different lots, the nutritive ratio, which is the ratio of the digestible crude protein to the total digestible carbohydrates and fats, varied from 1:4.96 in lot I to 1:7.93 in lot IV, widening as corn was added. In all lots the average daily rations fed during the second period were narrower than those fed during the first half of the trial. Where cottonseed meal and silage are the principle feeds used, this would indicate the greater possibility for profit by adding corn during the latter part of the feeding period.*

*In Circualr 75 of the Extension Division of the University of Kentucky (pages 6 and 7) Prof. E. S. Good recommends that at the end of the 50th or 60th day, corn be introduced into the ration of cottonseed meal and corn silage at the rate of three pounds per head daily (shelled basis), this being gradually increased until the steers when they go to market, are getting fourteen pounds per head daily. This should be taken as referring to Kentucky conditions where corn is relatively cheaper than in Mississippi.

TABLE II. SUMMARY OF FEEDING TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING STEERS, WINTER 1916-17.

Date of Trial—October 17, 1916 to February 14, 1917
Length of Trial—120 Days
Breeding of Steers—Angus, Hereford, and Shorthorn Grades
Age of Steers—2 Years Old
Quality—Good to Choice
Initial Valuation per cwt.—$7.00

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration. Ration.
Number of Animals	8	8	8	8
Initial weight, total (lbs.)	6935.	6780.	7073.	6689.
Average initial weight (lbs.)	866.9	847.5	884.1	836.1
Final weight, total (lbs.)	8847.	8921.	9347.	9105.
Average final weight (lbs.)	1105.9	1115.1	1168.4	1138.1
Total gain (lbs.)	1912.	2141.	2274.	2416.
Average gain per steer (lbs.)	239.	267.6	284.3	302.
Average daily gain per steer (lbs.)	1.99	2.23	2.37	2.52
Weight at market, total (lbs.)	8298.4	8198.4	8652.	8647.2
Average weight at market (lbs.)	1037.3	1024.8	1081.5	1080.9
Total shrink (lbs.)	548.6	722.6	695.	457.8
Shrink per steer (lbs.)	68.6	90.3	86.9	57.2
Percent of shrink	6.23	8.09	7.44	5.03
Dressing percent, based on market weight	56.6	55.98	57.74	58.9
Dressing percent, based on home weight	53.09	51.45	53.45	55.94
Feed consumed, total				
Cottonseed meal (lbs.)	5239.	4309.	3432.	2294.
Broken ear corn (lbs.)		6056.	11918.4	18405.6
Corn silage (lbs.)	66970.	49350.	48690.	38462.
Feed consumed per steer				
Cottonseed meal (lbs.)	654.9	538.6	429.	286.8
Broken ear corn (lbs.)		757.	1489.8	2300.7
Corn silage (lbs.)	8371.3	6168.8	6086.3	4807.8
Average daily feed per steer				
Cottonseed meal (lbs.)	5.46	4.49	3.58	2.39
Broken ear corn (lbs.)		6.31	12.42	19.17
Corn silage (lbs.)	69.76	51.41	50.72	40.06
Feed required per cwt. of grain				
Cottonseed meal (lbs.)	274.	201.3	150.9	94.9
Shelled corn (lbs.)*		226.3	419.26	609.44
Corn silage (lbs.)	3502.6	2305.	2141.	1591.8
Cost of 100 lbs. of grain	$ 12.14	$ 12.43	$ 14.60	$ 15.84
Selling price of steers per cwt.	10.05	10.21	10.53	11.00
Gross receipts per steer	104.25	104.63	113.88	118.90
Shipping and selling expense per steer	3.52	3.52	3.52	3.52
Net receipts per steer	100.73	101.11	110.36	115.38
Initial valuation of steer in feed lot	60.68	59.33	61.89	58.53
Feed cost per steer	29.02	33.25	41.50	47.86
Initial valuation and feed cost per steer	89.7	92.58	103.39	106.39
Profit†	11.03	8.53	6.97	8.99

The following tabulation shows the average daily gain per steer by lots during the two sub-periods:

TABLE III. AVERAGE DAILY GAIN BY SUB PERIODS—1916-17

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration	LOT III C.S.M. Silage Medium Corn Ration	LOT IV C.S.M. Silage Heavy Corn Ration
First Sub-Period, 62 Days, (lbs.)	3.00	2.72	2.88	2.78
Second Sub-Period, 58 Days (lbs.)	.92	1.70	1.83	2.23
Average daily gain for entire period, 120 Days, (lbs)	1.99	2.23	2.37	2.52

*For the purpose of comparison the corn eaten per hundred pounds of gain was reduced to shelled baisis.

†The term "Profit" as used refers to the excess net receipts over the cost of steer and feed. In calculating "Profit", no account was taken of labor, interest, risk, etc. This should be borne in mind, otherwise the term will be misleading.

Notwithstanding the larger average daily rations fed during the latter part of the trial, the average daily gains were smaller in each instance than during the first sub-period. This was due largely to the fill taken on by the cattle during the early part of the feeding period and partly, perhaps, to the more expensive gains expected as the feeding period advances.*

For the entire trial, the average daily gain varied with the corn used in the ration. Based on initial and market weights, however, instead of on initial and final weights in the feed lot, there was little difference in the gains made by lot I receiving cottonseed meal as the sole concentrate, and lot II receiving the light corn ration.

Based on percentages given by Henry and Morrison the dry matter consumed per hundred pounds of gain was greatest in lot I and smallest in lot II. Due to the much heavier consumption of silage in lot I, however, this apparent difference may have been due largely to a variation from the average percentage used in the calculation of the dry matter in the silage. The total digestible nutrients consumed per cwt. of gain was smallest in lot II and greatest in lot IV. The feed cost per hundred pounds of gain increased as corn was added in the ration, varying from $12.14 in lot I to $15.84 in lot IV.

The dressing per cent was highest in lot IV and lowest in lot II. Though lot I showed a higher dressing per cent than lot II, a premium of sixteen cents per cwt. was paid for the latter lot as compared with the former. This was probably due to a difference in the coats of the two lots, giving lot II the appearance of higher finish.

PORK PRODUCED BY HOGS AFTER STEERS

As already state due to difficulty in obtaining a car for shipment to market, the cattle used in this work were held for twelve days after the conclusion of the feeding trials. The hogs continued to follow the steers for this additional period and the following summary is for 132 days.

TABLE IV. SUMMARY OF HOGS FED IN LOTS WITH STEERS, 1916-17.

Number of Hogs used per lot 16
Initial Valuation per cwt. of Hogs in lot $7.50
Average length of time on feed ..... 66 days

RATION FED TO STEERS	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
Initial weight, total (lbs.)	1363.	1369.5	1448.	1459.5
Average initial weight (lbs.)	85.2	85.6	90.5	91.2
Final weight, total (lbs.)	2192.8	2171.	2514.2	2611.
Average final weight (lbs.)	137.	135.7	157.1	163.2
Total gain, pork produced (lbs.)	829.8	801.5	1066.2	1151.5
Average gain per hog (lbs.)	51.86	50.09	66.6	72.
Average daily gain per hog (lbs.)	.79	.76	1.01	1.09
Feed consumed, total				
Shelled corn (lbs.)	3775	2447.	2228.4	2049.
Cottonseed meal (lbs.)	262.5	210.	276.	211.
Average daily feed per hog				
Shelled corn (lbs.)	3.20	2.32	2.11	1.94
Cottonseed meal (lbs.)	.25	.20	.26	.20
Feed required per cwt. of gain				
Shelled corn (lbs.)	406.7	305.3	209.	177.9
Cottonseed meal (lbs.)	31.6	26.2	25.9	18.3
Cost of 100 pounds of gain	$ 7.85	$ 5.94	$ 4.22	$ 3.52
Selling price of pigs per cwt. at market	10.77	10.74	10.75	10.76
Shipping and selling expense per cwt.	.782	.80	.853	.738
Gross receipts	236.09	233.25	270.22	281.01
Shipping and selling expense per lot	17.15	17.36	21.46	19.27
Net receipts	218.94	215.89	248.76	261.74
Initial valuation of hogs	102.23	102.71	108.60	109.46
Cost of feed	65.19	47.63	44.97	40.55
Cost of hogs and feeds	167.42	150.34	153.57	150.01
Profit per lot (lbs.)	51.52	65.55	95.19	111.73
Profit per hog (lbs.)	3.22	4.10	5.95	6.98

*According to Henry and Morrison (page 436), "Other conditions being equal, the higher the degree of finish to which the animal is carried, the larger the quantity of feed required to produce a given gain." For this reason, feeding periods for yearlings and year old steers in this State seldom exceed one hundred and twenty to one hundred and forty days.

While no check hogs were used with which to compare those after the steers it is evident from comparing the feed required per hundred pounds of gain in lot I with the average feed consumed per cwt. of gain by hogs in large numbers of trials* that little, if any, of the gains made by the hogs in this lot could be credited to the cattle. By using lot I as a check, 24.6% of the gains in lot II, 46.6% of the gains in lot III and 55.1% of the gains in lot IV can be credited to the steers, or 197 pounds, 497 pounds and 635 pounds respectively to lots II, III and IV. To secure the amounts of pork that might be credited for the one hundred and twenty days, ten elevenths of these amounts were used† or 179 pounds in lot II, 452 pounds in lot III and 577 pounds in lot IV.

From these figures it is seen that the pork produced by the steers varied with the corn in the ration.

FINANCIAL SHOWING.

Without considering the profits from the hogs fed after the steers, the best financial showing was made by lot 1, followed by lots IV, II and III in the order named. Combining the profits from the hogs and the steers, the best showing was made by lot IV followed by lots III, I and II in the order named.

In the preliminary statement at the close of the trial it was pointed out that the results indicated that ear corn could not be fed profitably to fattening steers with the prices prevailing, unless hogs were used to follow the cattle.

The financial returns from the combined hog and cattle feeding operations were highly satisfactory, especially considering the advantages of such operations in solving the problems of soil fertility and of labor distribution throughout the year.

FEEDING TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING YEARLING STEERS, WINTER 1918-19

The steer feeding conducted during the winter of 1918-19 was a continuation of the work started in 1916 to secure data on cottonseed meal, and cottonseed meal and varying proportions of corn, fed with corn silage for fattening beef steers.

Forty steers, averaging 610.2 pounds were divided into four groups as nearly equal as possible in breeding, quality, condition, conformation and weight. Younger cattle were used than in the 1916-17 work and they were carried for a longer period. The steers were started on feed December 11 and were fed one hundred and forty days, being put on the market about May 1. By finishing at that time, advantage was secured of seasonal prices and extension of the feeding period into the extremely warm weather was avoided. With the exception of the matter of rations, the cattle in all of the lots were fed and handled in a manner as nearly as possible identical. The rations used in each of the lots were similar to those used in the corresponding lots in 1916-17.

CATTLE.

The cattle used were yearling beef steers mostly grade Shorthorns, bought on the St. Louis market in December, 1918. While possibly not as good as the steers produced each year on the Experiment Station farm out of cows bred up from native stock by the use of pure bred Hereford, Shorthorn and Angus bulls, they would have graded as good to choice feeders, possessing quality frequently difficult to obtain locally.

*"Pork Production," by W. W. Smith, page 276. "Feeds and Feeding," by Henry and Morrison, page 587.

†While this method of calculation admits of considerable error, the approximation should be of value in giving a fairly accurate idea of the pork which can be made with the different rations.

FEED AND FEED PRICES.

Cottonseed meal was charged against the cattle at $62.00 per ton. Corn was fed in the ear and was charged at $1.50 per bushel. Silage was charged at $7.00 per ton. Tankage fed to hogs following the steers was charged at $5.10 per hundred pounds.

RATIONS

Lot I received from three pounds of cottonseed meal daily per thousand pounds of weight of steers in the beginning of the trial to eight pounds of cottonseed meal daily per thousand pounds weight at the close. Lot II received from two pounds of cottonseed meal and three pounds of broken ear corn daily per thousand pounds weight to seven pounds of cottonseed meal and 6.25 pounds of broken ear corn daily per thousand pounds. Lot III received from one pound of cottonseed meal and four pounds of broken ear corn per thousand pounds to six pounds of cottonseed meal and 12.5 pounds of corn per thousand pounds. Lot IV received cottonseed meal from one pound daily per thousand pounds weight in the beginning to five pounds daily per thousand pounds weight at the close, and broken ear corn from five pounds daily per thousand pounds weight at the beginning to 18.75 pounds daily per thousand pounds weight at the close. The steers in each lot received all of the corn silage they would eat.

TABLE V. AVERAGE DAILY RATION BY SUB-PERIODS, WINTER 1918-19

RATION	LOT I	LOT II	LOT III	LOT IV
	C.S.M. Silage	C.S.M. Silage Light Corn Ration.	C.S.M. Silage Medium Corn Ration.	C.S.M. Silage Heavy Corn Ration.
First Sub-Period (28 days)				
Cottonseed meal (lbs.)	2.76	2.22	1.56	1.21
Broken ear corn (lbs.)		2.77	5.36	7.90
Corn silage (lbs)	33.63	34.09	32.20	26.96
Second Sub-Period (28 days)				
Cottonseed meal (lbs.)	3.87	3.30	2.62	2.01
Broken ear corn (lbs.)		4.17	8.21	13.96
Corn silage (lbs)	35.00	35.80	25.3	20.30
Third Sub-Period (28 days)				
Cottonseed meal (lbs.)	4.89	4.37	3.56	2.74
Broken ear corn (lbs.)		4.58	8.90	14.29
Corn silage (lbs)	35.00	34.80	25.4	22.23
Fourth Sub-Period (56 days)				
Cottonseed meal (lbs.)	5.95	5.44	4.67	4.11
Broken ear corn (lbs.)		4.80	9.73	15.00
Corn silage (lbs)	41.34	34.80	29.7	20.74
Av. daily ration for entire period (140 days)				
Cottonseed meal (lbs.)	4.68	4.16	3.42	2.85
Broken ear corn (lbs.)		4.23	8.38	12.92
Corn silage (lbs)	37.26	34.65	28.46	22.19

The concentrates were gradually increased as the feeding trial progressed while the steers were put on practically a full feed of silage from the first. The silage consumed varied inversely with the corn used in the ration. The total dry matter and total nutrients in the ration and the net energy values of the ration increased as corn was added.

TABLE VI. SUMMARY OF FEEDING TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING STEERS, WINTER 1918-19

Date of Trial—December 11, 1918 to April 29, 1919
Length of Trial—140 Days
Breeding of Steers—Mostly Grade Shorthorns
Age of Steers—Yearlings
Quality—Good to Choice
Initial Valuation per cwt.—$9.25

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
Number of Animals	10	10	10	9*
Initial weight, total (lbs.)	5971.	6162.7	5993.3	5670.
Average initial weight (lbs.)	597.1	616.3	599.3	630.
Final weight, total (lbs.)	8558.	8836.	8903.	8391.6
Average final weight (lbs.)	855.8	883.6	890.3	932.4
Total gain (lbs.)	2587.	2673.3	2903.	2721.6
Average gain per steer (lbs.)	258.7	267.3	290.3	302.4
Average daily gain per steer (lbs.)	1.85	1.91	2.08	2.16
Weight of steers at market, total (lbs.)	8380.	8560.	8770.	8280.
Average weight at market, total (lbs.)	838.	856.	877.	920.
Average shrink per steer (lbs.)	17.8	27.6	13.3	12.4
Percent of shrink	2.08	3.12	1.49	1.33
Dressing per cent. based on market weight	49.54	53.6	53.49	56.44
Dressing per cent. based on home weight	48.51	51.93	52.69	55.69
Feed consumed, total				
Cottonseed meal (lbs.)	6557.9	5816.9	4783.7	3586.
Broken ear corn (lbs.)		5926.4	11737.	16282.
Corn silage (lbs.)	52165.	48517.	39847.	27958.
Feed consumed per steer				
Cottonseed meal (lbs.)	655.8	581.7	478.4	398.4
Broken ear corn (lbs.)		592.6	1173.7	1809.1
Corn silage (lbs.)	5216.5	4851.7	3984.7	3106.4
Average daily feed per steer				
Cottonseed meal (lbs.)	4.68	4.16	3.42	2.85
Broken ear corn (lbs.)		4.23	8.38	12.92
Corn silage (lbs.)	37.26	34.65	28.46	22.19
Feed required per cwt. of gain				
Cottonseed meal (lbs.)	253.49	217.59	164.78	131.76
Shelled corn (lbs.)†		177.25	323.44	478.6
Corn silage (lbs.)	2016.4	1814.9	1372.6	1027.3
Cost of 100 pounds of gain	$ 14.92	$ 17.85	$ 18.58	$ 20.50
Selling price per cwt.	12.75	13.00	13.25	14.00
Gross receipts per steer	106.84	111.28	116.20	128.80
Shipping and selling expense per steer	6.28	6.42	6.58	6.90
Net receipts per steer	100.56	104.86	109.62	121.90
Initial valuation per steer in feed lot	55.23	57.00	55.44	58.28
Feed cost per steer	38.59	47.71	53.94	61.99
Initial valuation and feed cost per steer	93.82	104.71	109.38	120.27
Profit per steer	6.74	.15	.24	1.63

As in the preceding trial, the average daily gain per steer varied with the corn fed in the ration. The following tabulation shows the average daily gain by sub-periods:

†For the purpose of comparison the corn eaten per hundred pounds of gain was reduced to shelled basis.

*There were originally ten steers in each of the lots, one steer in lot IV became lame, however, and had to be taken out at the end of the second sub-period. It was estimated that up to the time of his removal he consumed the average amount of feed eaten by the whole lot and, on this basis, he was figured entirely out of the experiment, leaving only nine steers in that lot.

TABLE VII. AVERAGE DAILY GAIN BY SUB-PERIODS 1918-19

RATION	LOT I C.S.M Silage	LOT II C.S.M Silage Light Corn Ration	LOT III C.S.M Silage Medium Corn Ration	LOT IV C.S.M Silage Heavy Corn Ration
First Sub-Period, 28 Days, (lbs.)	1.73	1.55	2.06	1.7
Second Sub-Period, 28 Days, (lbs.)	1.88	2.45	1.95	3.1
Third Sub-Period, 28 Days, (lbs.)	1.65	1.75	2.37	2.1
Fourth Sub-Period, 56 Days, (lbs.)	1.99	1.89	2.00	1.95
Av. daily gain for entire period, 140 days, (lbs.)	1.85	1.91	2.08	2.16

From this it will be seen that while there was some variation in the average daily gains during the different sub-periods this difference was not nearly as marked as in the previous trial. The gains were smaller than in the 1916-17 trial which may have been due to the fact that the cattle were younger and smaller, or that they were not of quite the same quality as those used in the first trial. The gain and the average daily gain as shown in the summary are based on the initial and final weights in the feed lot. If calculated from the initial weight in the feed lot and the final weight at market, there would have been again practically no difference in the gains made by lot I, receiving cottonseed meal as the sole concentrate, and lot II receiving the light corn ration.

The shrink was extraordinarily light in all lots. As in the previous trial, it was smaller in the lots receiving the medium and heavy corn rations than in the other lots. The selling price and dressing per cent increased with the higher per cent of corn in the ration*.

The dry matter consumed per hundred pounds of gain was smallest in lot I and greatest in lot II. The total nutrients and the net energy values required per cwt. of gain were smallest in lot I and greatest in lot IV, increasing as corn was added in the ration. The dry matter, digestible nutrients and net energy values per cwt. of gain were smaller than in the preceding trial. This was notwithstanding the longer feeding period and was probable due to the younger age of the cattle.† The cost of gains varied from $14.92 per cwt. in lot I to $20.50 in lot IV, increasing with the addition of corn. The gains were more expensive this year than in the first trial, due to the advance in feed prices.

HOGS FOLLOWING STEERS

Ten shoats averaging about seventy-five pounds were put in each lot and were allowed to run for a limited time each day to self feeders containing shelled corn and tankage in separate compartments. Lot I was allowed access to the self-feeder for two hours each day and all of the other lots one hour a day. The following is a summary of the results obtained:

*The following comments on the different lots by Mr. F. W. Manker, Beef Department, Swift & Co., are based on a study of the carcasses.

Lot I. "Common quality, carry very little fat."

Lot II. "While not as good quality and shape at the nine steers (lot IV), show a more even distribution of fat especially on the rounds."

Lot III. "Have fair quality, show large frame and shallow loins, a fair covering of fat."

Lot IV. 'Are the best quality cattle and carry most fat, although fat is not evenly distributed over carcass."

†"Influence of Age on Cost of Fattening", "Fattening Calves, Yearlings and Two year Olds", and "Feeds and Feeding", Henry and Morrison, pages 433 and 434.

TABLE VIII. HOGS FED IN LOTS WITH STEERS, 1918-19

Number of Hogs Used per Lot---10
Value of Pork produced---$20.00 per cwt.

RATION	LOT I	LOT II	LOT III	LOT IV
Initial weight, total (lbs.)	724.27	731.70	745.00	755.00
Average initial weight (lbs.)	74.23	73.17	74.5	75.5
Final weight, total (lbs.)	1796.	1710.	1836.	2022.
Average final weight (lbs.)	179.6	171.	183.6	202.2
Total gain, pork produced (lbs.)	1053.7	978.3	1096.	1267.
Average gain per hog (lb.s)	105.37	97.83	109.6	126.7
Average daily gain per hog (lbs.)	.753	.699	.783	.905
Feed consumed, total				
Shelled corn (lbs.)	4432.	3307.	2971.5	2491.5
Tankage (lbs.)	556.	267.	258.25	210.
Average daily feed per hog				
Shelled corn (lbs.)	3.166	2.362	2.122	1.78
Tankage (lbs.)	.397	.191	.184	.15
Feed required per cwt. of gain				
Shelled corn (lbs.)	420.6	338.	271.1	196.6
Tankage (lbs.)	52.8	27.3	23.6	16.6
Cost of 100 lbs. of gain	$ 13.96	$ 10.45	$ 8.47	$ 6.11
Value of gain made	210.74	195.66	219.20	253.40
Cost of feed	147.07	102.20	92.76	77.45
Profit	63.67	93.46	126.44	175.95
Profit per hog	6.37	9.35	12.64	17.60

The weight of hogs per thousand pound weight of cattle was greater than in 1916-17, more pork was made and a larger amount of feed was consumed by the hogs following the steers. The following table showing the amount of feed required per hundred pounds of pork produced during each of the two years presents an interesting study:

TABLE IX. FEED REQUIRED PER HUNDRED POUNDS OF PORK PRODUCED AFTER STEERS, 1916-17 AND 1918-19

RATION	LOT I C.S.M.	LOT II Light Corn Ration.	LOT III Medium Corn Ration.	LOT IV Heavy Corn Ration.
1916-17—				
Corn (lbs.)	405.70	303.00	208.00	177.80
Cottonseed meal (lbs.)	30.5	26.3	25.7	18.3
Total (lbs.)	436.2	329.3	233.7	196.1
1918-19—				
Corn (lbs.)	420.6	338.	271.1	196.6
Tankage (lbs.)	52.8	27.3	23.6	16.6
Total (lbs.)	473.4	365.3	294.7	213.2

In order to show how much of the gains made by the hogs could be legitimately credited to the steers, a check lot of hogs not following cattle should have been carried each year with access to self feeders containing the same feeds used in these trials. By comparing the feed consumed per hundred pounds of gain, however, in the different lots each year with averages given by Smith and by Henry and Morrison*, it will be seen that very little, if any, saving was effected from the droppings of the steers in lot I where cottonseed

*Tabulations by Smith, based on thirty-five experiments with corn and protein supplement, give 436.23 pounds as the average amount of corn and supplement eaten per hundred pounds gain. An average of eight experiments shows 378.82 pounds of corn and 24.53 pounds of tankage eaten for each hundred pounds of gain. (Pork production, W. W. Smith, page 276.) In thirty-two trials (according to Henry and Morrison, page 587), an average of 441 pounds of corn and supplement were required for one hundred pounds of gain.

meal was the sole concentrate fed to the steers. By using Lot I as a check, the following tabulation, based on calculations using the tables of digestible nutrients given by Henry and Morrison shows the percent of gain and the gain made by the hogs in Lots II, III and IV., which might be credited to the cattle.

TABLE X. GAINS BY HOGS CREDITED TO STEERS, 1916-17 AND 1918-19

Steer Ration	LOT					
	Lot II Light Corn Ration		Lot III Med'm Corn Ration		Lot IV Heavy Corn Ration	
	Percent	Pounds	Percent	Pounds	Percent	Pounds
1916-17	24.57%	179.14lbs.	46.61%	451.78lbs.	55.14%	557.22lbs
1918-19	19.84%	194.08lbs.	35.32%	387.11lbs.	53.21%	674.17lbs

Valuing the pork made after the steers in 1918-19 at twenty cents per pound, lots II, III and IV would be credited respectively with $38.81, $77.42 and $134.83 per lot, or $3.88, $7.74 and $14.98 per steer.

FINANCIAL SHOWING 1918-19

Without considering the pork produced, the best financial showing was made by lots I, IV, III, and II as named. Adding the value of the pork credited to the different lots to the profit from the steers and the best financial showing was made by lot IV, followed by lots III, I and II in the order named. Combining the profit from the steers and hogs the results were highly satisfactory, indicating that with the prices of feed and livestock prevailing during the period of this trial good profits could be made from the feeding of cattle and hogs.

FEEDING TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN AND COTTONSEED MEAL FED WITH CORN SILAGE FOR FINISHING TWO-YEAR OLD STEERS, SPRING 1920

Forty steers averaging 805 pounds were used in this trial, being fed in four lots, corresponding to those used in the two trials already reported. Some of the cattle used were bought from local cattle raisers and some were bred and raised by the Mississippi Agricultural Experiment Station. An additional lot was fed this year, in which molasses was substituted for corn in the concentrate portion of the ration. The results obtained from the molasses feeding will be reported in a bulletin on that subject. As in previous trials, with the exception of the concentrate portion of the rations, all variable factors were eliminated as far as possible. The cattle were started on feed January 16 and were fed for one hundred and twelve days. Their initial valuation in the feed lot was $8.50 per cwt.

HOGS.

Shoats averaging about a hundred pounds were used after the cattle, the number being regulated by the amount of corn fed to the steers. The hogs received no feed other than that secured from the steers. At the beginning the total weight of hogs in lot I was two hundred and fifty pounds; in lot II four hundred and ten pounds; in lot III, five hundred and fifteen pounds; in lot IV, seven hundred and eighty-two pounds. At the conclusion of the third sub-period, the hogs were changed and the number used reduced, indicating that too many hogs were used in the lots during the first part of the trial. The pork made was credited to the steeers at thirteen cents per pound, or its value locally at the conclusion of the feeding trials.

FEED PRICES

Cottonseed meal was charged against the cattle at $72.00 per ton, corn at $1.50 per bushel and corn silage at $8.00 per ton. The reason for charging corn silage at $8.00 per ton instead of $7.00, as in the 1918-19 work was the increased cost of labor the latter year.

RATIONS

The steers in each lot were given all the corn silage they would consume. In addition lot I received cottonseed meal from 2.4 pounds per head daily at the beginning to 7.6 pounds per head daily at the close. Lot II received cottonseed meal from 1.6 pounds per head daily at the beginning to 6.6 pounds per head daily at the close, and shelled corn from 2.4 pounds per head daily at the begining to 4.8 pounds per head daily at the close. Lot III received cottonseed meal from .8 pounds per head daily at the beginning to 6. pounds per head daily at the close, and shelled corn from 3.2 pounds per head daily at the beginning to 10. pounds per head daily at the close. Lot IV received cottonseed meal from .8 pounds per head daily at the beginning to 5. pounds per head daily at the close, and shelled corn from 4. pounds per head daily at the beginning to 14.8 pounds per head daily at the close.

TABLE XI. AVERAGE DAILY RATION BY SUB-PERIODS, SPRING 1920

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
First Sub-Period (28 days)				
Cottonseed meal (lbs.)	3.64	2.77	2.01	1.58
Corn (lbs.)*		2.78	5.57	7.86
Corn silage (lbs.)	34.00	32.50	32.90	26.20
Second Sub-Period (28 days)				
Cottonseed meal (lbs.)	5.00	4.20	3.60	2.60
Corn (lbs.)		4.30	8.63	12.96
Corn silage (lbs.)	46.70	41.10	39.10	23.90
Third Sub-Period (28 days)				
Cottonseed meal (lbs.)	6.30	5.40	4.70	3.80
Corn (lbs.)		4.47	9.35	14.25
Corn silage (lbs.)	58.70	42.30	37.60	28.00
Fourth Sub-Period (28 days)				
Cottonseed meal (lbs.)	7.34	6.36	5.79	4.83
Corn (lbs.)		4.80	10.00	14.80
Corn silage (lbs.)	50.60	45.70	41.10	29.40
Av. daily ration for entire period (112 days)				
Cottonseed meal (lbs.)	5.57	4.68	4.03	3.19
Corn (lbs.)		4.09	8.39	12.47
Corn silage (lbs.)	47.43	40.39	37.64	26.86

It will be noted that the silage consumed by the steers in lot I increased for the first three twenty-eight day periods and decreased for the last twenty eight days In lot II, the increase in the consumption of silage continued for each of the succeeding four periods, while in lots III and IV, the consumption of silage was greatest during the last period. The consumption of silage in the different lots varied as in the other trials inversely with the corn in the ration. The dry matter and digestible nutrients in the ration increased as corn was added, in each instance corresponding with the weight of the steers rather closely to the average of the four years trial reported herein. The net energy values of the rations used also incrased as corn was added. The nutritive ratio widened with the use of corn in the ration.

*During the first and second sub-periods and part of the third, broken ear corn was fed, while for the remainder of the trial shelled corn was substituted. In this table, all corn is reduced to the shelled basis.

TABLE XII. SUMMARY OF FEEDING TRIALS WITH COTTONSEED MEAL AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING STEERS, SPRING 1920

Date of Trial—January 16, 1920 to May 7, 1920
Length of Trial—112 Days
Breeding of Steers—Angus, Hereford, and Shorthorn Grades
Age of Steers—Two Years Old
Quality—Good to Choice
Initial Valuation per cwt.—$8.50

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
Number of Animals	10	10	10	10
Initial weight, total (lbs.)	8045.	7979.00	8110.00	8060.
Average initial weight (lbs.)	804.5	797.9	811.	806.
Final weight, total (lbs.)	9926.	10226.	10838.	10910.
Average final weight (lbs.)	922.6	1022.6	1083.8	1091.
Total gain (lbs.)	1881.	2247.	2728.	2850.
Average gain per steer (lbs.)	188.1	224.7	272.8	285.
Average daily gain per steer (lbs.)	1.68	2.01	2.44	2.54
Weight at market (lbs.)	9210.	9530.	10120.	10330.
Average weight at market (lbs.)	921.	953.	1012.	1033.
Total shrink (lbs.)	716.	696.	718.	580.
Shrink per steer (lbs.)	71.6	69.6	71.8	58.
Percent. of shrink	7.21	6.81	6.63	5.32
Dressing percent. based on market weight	55.13	55.28	55.85	57.1
Dressing per cent. based on home weight	51.15	51.52	52.15	54.06
Pork produced by hogs after steers (lbs.)	25.	155.	330.	223.
Feed consumed, total				
Cottonseed meal (lbs.)	6240.	5246.	4508.	3568.
Shelled corn (lbs.)		2131.5	4437.25	6637.75
Broken ear corn (lbs.)		3057.	6196.5	9155.
Corn silage (lbs.)	53210.	45245.	42160.	30078.
Feed consumed per steer				
Cottonseed meal (lbs.)	624.	524.6	450.8	356.8
Shelled corn (lbs.)		213.15	443.73	663.78
Broken ear corn (lbs.)		305.7	619.65	915.5
Corn silage (lbs.)	5321.	4524.5	4216.	3007.8
Average daily feed per steer				
Cottonseed meal (lbs.)	5.57	4.68	4.03	3.19
Shelled corn (lbs).*		4.09	8.39	12.46
Corn silage (lbs.)	47.51	40.40	37.64	26.86
Feed required per cwt. of gain				
Cottonseed meal (lbs.)	331.74	233.47	165.25	125.19
Shelled corn (lbs).*		203.69	334.37	489.85
Corn silage (lbs.)	2828.81	2013.57	1545.45	1055.37
Cost of 100 pounds of gain	$ 23.26	$ 21.92	$ 21.35	$ 21.85
Selling price per cwt.	11.60	11.60	12.00	12.25
Gross receipts per steer	106.84	110.55	121.44	126.54
Shipping and selling expense per steer	4.28	4.38	4.55	4.62
Net receipts per steer	102.56	106.17	116.89	121.92
Initial valuation per steer in feed lot	68.38	67.82	68.94	68.51
Feed cost per steer	43.75	49.24	58.25	62.27
Initial valuation and feed cost per steer	112.13	117.06	127.19	130.78
Profit or loss per steer	—9.57	—10.89	—10.30	—8.86
Profit or loss per steer, crediting pork†		—8.88	—6.01	—5.96

In the different lots, the average daily gain increased with the increased use of corn in the ration. The following tabulation shows the average gain by sub-periods of twenty-eight days each:

*For the purpose of comparison the corn eaten per hundred pounds of gain was reduced to shelled basis.

†Pork was credited to steers at 13 cts. per cwt. No feed was fed to hogs following cattle.

TABLE XIII. AVERAGE DAILY GAIN BY SUB-PERIODS, SPRING 1920

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III. C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
First Sub-Period, 28 days, (lbs.	1.39	1.72	1.96	1.88
Second Sub-Period, 28 days, (lbs.)	2.02	1.66	2.57	3.25
Third Sub- Period, 28 days, (lbs.)	1.50	2.13	1.86	1.09
Fourth Sub-Period, 28 days, (lbs.)	1.81	2.52	3.35	3.96
Av. daily gain entire period, 112 days, (lbs.)	1.68	2.01	2.44	2.54

The gains held up well in all of the lots throughout the entire feeding period. In lots II, III and IV, the gains were the greatest during the last twenty-eight days. The per cent of shrink was smallest again in lot IV, but was heaviest in lot I. As in the earlier trials it was smaller in lots III and IV, receiving the medium and heavy corn rations than in lot II, receiving the light corn ration, or lot I where cottonseed meal was the sole concentrate fed. The dressing per cent increased as corn was added in the ration*. There was no difference in the selling price of lots I and II. The selling price of lots II, III and IV correlated rather closely with the dressing per cent.

The dry matter eaten per cwt. of gain varied inversely as corn was added in the ration. The digestible nutrients and net energy values per cwt. of gain were smallest in lot III and greatest in lot I. The nutritive ratios of the rations used compared closely with those used in 1918-19, as well as to the averages for the four years' trials.

The gains this year were the most expensive of any during the four years' work due to the extremely high feed prices prevailing. They were highest in lot I and lowest in lot III.

More pork was made behind the steers in lot III, receiving a medium corn ration than behind those in lot IV, where a greater amount of corn was fed to the cattle. This may have been due partly to the number and partly to the individuality of the hogs used. Two shoats were kept behind the steers in lot I until the last sub-period. These showed a loss to that time of forty pounds. During the last sub-period, one hog was kept in lot I and made a gain of fifteen pounds. This indicates that not more than one 100 lb. shoat should be used to follow ten steers, fed only on cottonseed meal and corn silage.

Where no pork was credited to the steers in either lot, it is seen that the best financial showing was made by lot IV followed by lots I, III and II in the order named. In each lot there was a loss on the operations. This was due to economic conditions generally unfavorable to the finishing of cattle. The fact that lot I made a better showing than lot II could not be charged against the corn used in the ration of lot II as the cost of gains was cheapened thereby, but the better financial showing of lot I was due rather to the economic conditions just mentioned. Where the pork produced behind the cattle was credited, the loss decreased as the corn was increased in the ration used.

The steers used in these trials sold at the highest figures that any Mississippi beeves had brought that year. The top of the market on beef steers for the day they were sold was $13.00 per cwt.

*According to the report received from the Dressed Beef Department of Armour & Company, the percentage of fat as follows: Lot I, 3.6%; lot II, 3.93%; lot III,5.55%; and lot IV, 5%.

FEEDING TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN AND COTTONSEED MEAL FED WITH CORN SILAGE FOR FINISHING TWO-YEAR OLD STEERS 1920-21

Due to prevailing economic conditions unfavorable to the finishing of cattle, the number of lots this year was reduced to three, lot IV being dropped. Twenty-five steers were used averaging in weight 862 pounds nine being put in lot I and eight each in lots II and III. Most of the steers used were bred and raised on the station farm, though a few were purchased locally. In quality and condition they were comparable with those used in the earlier trials.

The number of hogs following the cattle was regulated by the amount of corn in the steer ration. One hog was kept in lot I. During the first part of the trial two hogs were kept in lot II and for the latter part, when a heavier corn ration was being fed, three were used. In lot III three hogs were used at the beginning and four towards the end of the trial. When put into the lots the hogs averaged about one hundred pounds.

The cattle were started on feed December 31 and the trial was concluded April 23.

FEED PRICES

Cottonseed meal was charged at $40.00 per ton, corn $1.00 per bushel and corn silage at $5.00 per ton.

RATIONS

The rations in each of the lots were the same as were used in the corresponding lots in the previous trials and similar methods were used of bringing the cattle up to full feed.

TABLE XIV. AVERAGE DAILY RATION BY SUB-PERIODS, 1920-21

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.
First Sub -Period (28 days)			
Cottonseed meal (lbs.)	3.77	2.92	2.13
Corn (lbs.)		3.63	7.35
Corn silage (lbs.)	40.92	40.96	37.56
Second Sub-Period (28 days)			
Cottonseed meal (lbs.)	5.66	4.75	3.75
Corn (lbs.)		5.88	11.88
Corn silage (lbs.)	47.22	42.95	35.69
Third Sub-Period (28 days)			
Cottonseed meal (lbs.)	7.11	6.25	5.03
Corn (lbs.)		6.50	13.10
Corn silage (lbs.)	50.34	43.91	33.71
Fourth Sub-Period (30 days)			
Cottonseed meal (lbs.)	8.67	7.75	6.63
Corn (lbs.)		6.87	13.88
Corn silage (lbs.)	52.93	40.96	30.83
Av. daily ration for the entire period (114 days)			
Cottonseed meal (lbs.)	6.34	5.46	4.47
Corn (lbs.)		5.74	11.59
Corn silage (lbs.)	47.85	42.00	34.26

As in the former trials the consumption of silage decreased in the different lots as the per cent of corn increased in the ration. In lot I the consumption of silage increased for each sub-period, while lot II showed an increase up to the last sub-period, when there was a small decline. In lot III there was, after the first, a decrease in the silage consumption in each succeeding sub-period. The nutritive ratio in the different lots widened as the per cent of corn increased in the ration.

TABLE XV. SUMMARY OF FEEDING TRIALS WITH COTTONSEED MEAL AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FED WITH CORN SILAGE FOR FINISHING STEERS, WINTER 1920-21

Date of Trial—December 30, 1920 to April 23, 1921
Length of Trial—114 Days
Breeding of Steers—Angus, Hereford, and Shorthorn Grades
Age of Steers—Two year olds
Quality—Good to Choice
Initial Valuation per cwt.—$7.00

RATION	LOT I. C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.
Number of Animals	9	8	8
Initial weight, total (lbs.)	7720.	6911.	6916.
Average initial weight (lbs.)	857.8	863.9	864.5
Final weight, total (lbs.)	10373.3	9478.	9443.
Average final weight (lbs.)	1152.6	1184.75	1180.4
Total gain (lbs.)	2653.3	2567.	2527.
Average gain per steer (lbs.)	294.8	320.88	315.9
Average daily gain per steer (lbs.)	2.58	2.81	2.77
Weight of steers at market, total (lbs.)	9720.	8900.	8860.
Average weight at market (lbs.)	1080.	1112.5	1107.5
Average shrink (lbs.)	72.6	72.25	72.9
Percent. of shrink	6.29	6.10	6.18
Dressing per cent. based on market weight	56.06	55.47	56.77
Dressing per cent. based on home weight	52.53	52.09	53.26
Pork produced by hogs after steers (lbs.)	42.5	200.	370.
Feed consumed, total			
Cottonseed meal (lbs.)	6509.5	4978.	4081.
Shelled corn (lbs.)		5234.	10570.4
Corn silage (lbs.)	49094.	38305.	31242.5
Feed consumed per steer			
Cottonseed meal (lbs.)	723.28	622.25	510.13
Shelled corn (lbs.)		654.25	1321.3
Corn silage (lbs.)	5454.88	4788.13	3905.31
Average daily feed per steer			
Cottonseed meal (lbs.)	6.34	5.46	4.47
Shelled corn (lbs.)		5.74	11.59
Corn silage (lbs.)	47.85	42.00	34.26
Feed required per cwt. of gain			
Cottonseed meal (lbs.)	245.34	193.23	161.50
Shelled corn (lbs.)		203.89	418.30
Corn silage (lbs.)	1850.30	1492.21	1236.35
Cost of 100 pounds of gain	$ 9.53	$ 11.24	$ 13.79
Selling price per cwt.	7.40	7.40	7.40
Gross receipts per steer	79.92	82.33	81.96
Shipping and selling expense per steer	5.94	6.12	6.09
Net receipts per steer	73.98	76.21	75.87
Initial valuation per steer in feed lot	60.05	60.47	60.52
Feed cost per steer	28.10	36.07	43.56
Initial valuation and feed cost per steer	88.15	96.54	104.08
Loss per steer, pork not credited	14.17	20.33	28.21
Loss per steer, crediting pork*	13.82	18.43	24.74

The average daily gains were larger than in the corresponding lots in either of the previous trials. The largest average daily gain per steer was made in lot II and the smallest in lot I, this being the only trial in which the average daily gain per steer did not increase in each instance with the addition or increase of corn in the ration. As the dry matter and total nutrients in the ration, as well as the net energy values, increased with the addition of corn this is not explained in these data.

*Pork was credited to steers at $7.50 per cwt. No feed was fed to hogs following cattle.

TABLE XVI. AVERAGE DAILY GAIN BY SUB-PERIOD 1920-21

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.
First Sub-Period, 28 days, (lbs.)	3.10	2.92	2.92
Second Sub-Period, 28 days, (lbs.)	2.69	3.57	3.68
Third Sub-Period, 28 days, (lbs.)	2.04	2.03	2.10
Fourth Sub-Period, 30 days, (lbs.)	2.52	2.74	2.41
Av. daily gain for entire period, 114 days, (lbs.)	2.58	2.81	2.77

From this tabulation it is seen that during the last two sub-periods lot II made greater daily gains than did lot III. The very satisfactory gains in both lots, however, indicate that the cattle were doing well and that neither lot was off feed. In lots I and II less dry matter and digestible nutrients were consumed per cwt. of gain than were consumed by these lots in either of the other trials. The dry matter, digestible nutrients and net energy values increased as corn was added in the ration. The feed costs were the lowest of the four years, due to the light consumption of feed per cwt. of gain and to the decline in feed prices.

The gains made by the hogs after the cattle increased with the increased amount of corn fed to the cattle.

The cattle this year brought $7.40 per cwt., which was seventy cents below the top for the day on which they were sold, no premium being paid for the corn fed steers over those receiving cottonseed meal as the sole concentrate. The dressing per cent, however, indicated a higher finish in the two lots which received corn than in the cottonseed meal and silage lot. The following statement from the commission firm handling the cattle also bears out this point. Writing in this connection, Mr. J. R. Wooten, of Long, Wooten and Company, says referring to information secured from Swift & Company, who purchased the cattle, "Needless to say their beef man regarded group three as producing the most desirable carcass, group two the next best and group one the poorest."

As in preceding trials the general market condition was responsible for the unfavorable financial showing. Because of the small margin received, losses were recorded in all the lots. These were decreased somewhat when the pork made in the different lots was credited to the steers. The losses increased as the per cent of corn was increased in the ration.

TABLE XVII. RESULTS BY YEARS FOR CONVENIENCE IN COMPARISONS

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
Average Daily Gain per Steer (lbs.)				
1916-17	1.99	2.23	2.37	2.52
1918-19	1.85	1.91	2.08	2.16
Spring 1920	1.68	2.01	2.44	2.54
1920-21	2.58	2.81	2.77	
Average	2.00	2.19	2.37	2.39
Percent. of Shrink from Feed lot to Market				
1916-17	6.23	8.09	7.44	5.03
1918-19	2.07	3.12	1.49	1.33
Spring 1920	7.21	6.81	6.63	5.32
1920-21	6.29	6.10	6.18	
Average	5.56	6.07	5.53	4.05
Dressing Percent. based on Home weight				
1916-17	53.09	51.45	53.45	53.94
1918-19	48.51	51.93	52.69	55.69
Spring 1920	51.15	51.52	52.15	54.06
1920-21	52.53	52.09	53.26	
Average	51.39	51.74	52.86	55.14
Margin between cost & selling price per cwt.				
1916-17	$ 3.05	$ 3.21	$ 3.53	$ 4.00
1918-19	3.50	3.75	4.00	4.75
Spring 1920	3.10	3.10	3.50	3.75
1920-21	.40	.40	.40	
Average	2.47	2.62	2.92	4.16
Dry Matter in Ration (lbs.)*				
1916-17	23.40	22.19	25.55	26.48
1918-19	14.28	15.99	16.64	17.73
Spring 1920	17.65	18.61	21.14	21.17
1920-21	18.45	21.23	23.51	
Average	17.93	19.01	21.16	21.34
Total Nutrients in Ration (lbs.)*				
1916-17	16.62	16.94	20.30	22.10
1918-19	10.25	12.28	13.45	15.02
Spring 1920	12.77	14.32	17.00	17.93
1920-21	13.43	16.62	19.49	
Average	12.94	14.72	17.11	17.98
Total Dry Matter per cwt. of gain (lbs.)*				
1916-17	1174.63	994.96	1077.90	1051.87
1918-19	764.79	837.32	802.89	802.40
Spring 1920	1050.84	927.83	867.52	831.77
1920-21	713.57	753.67	848.93	
Average	896.04	871.40	890.23	894.50
Total Nutrients per cwt. of Gain (lbs.)*				
1916-17	834.22	759.34	856.27	878.25
1918-19	555.13	643.38	648.99	695.03
Spring 1920	760.12	713.54	697.90	704.50
1920-21	519.36	589.96	703.61	
Average	646.37	671.47	719.66	753.85
Nutritive Ratio Used*				
1916-17	1:4.96	1:5.50	1:6.73	1:7.93
1918-19	1:3.79	1:4.65	1:5.47	1:6.24
Spring 1920	1:3.94	1:4.76	1:5.71	1:6.44
1920-21	1:3.67	1:4.72	1:5.72	
Average	1:4.07	1:4.88	1:5.88	1:6.83
Net Energy Values in Ration (therms)†				
1916-17	16.19	17.19	20.27	22.28
1918-19	10.30	12.41	13.70	15.41
Spring 1920	12.76	14.44	17.23	18.36
1920-21	13.53	16.90	19.96	
Average	12.88	14.84	17.33	18.33
Net Energy values cwt. of Gain (therms)†				
1916-17	812.99	756.40	855.26	885.17
1918-19	557.52	650.05	660.63	713.20
Spring 1920	759.82	719.97	707.21	721.56
1920-21	523.49	599.64	720.47	
Average	643.70	676.78	729.20	768.23

Table XVII.—Continued

RATION	LOT I C.S.M. Silage	LOT II C.S.M. Silage Light Corn Ration.	LOT III C.S.M. Silage Medium Corn Ration.	LOT IV C.S.M. Silage Heavy Corn Ration.
Digestible Crude Protein in Ration (lbs.)*				
1916-17	2.79	2.61	2.63	2.48
1918-19	2.14	2.17	2.08	2.07
Spring 1920	2.58	2.48	2.53	2.41
1920-21	2.87	2.91	2.90	
Average	2.55	2.50	2.49	2.29
Digestible crude protein per cwt. of gain (lbs)				
1916-17	139.91	116.81	110.83	98.33
1918-19	115.97	113.77	100.33	95.95
Spring 1920	153.86	123.81	103.97	94.67
1920-21	111.13	103.21	104.73	
Average	127.49	114.12	104.57	96.22

*The total dry matter, total nutrients and digestible crude protein shown are based on calculations using the percentages given in table III appendix, Feeds and Feeding, by Henry and Morrison, 1922 edition.

†The net energy values given herein are based on the table of Net Energy Values by Armsby (Bulletin 459, U. S. Department of Agriculture.) A therm is the quantity of heat required to raise the temperature of 1000 kilograms (2204.6 pounds) of water 1° C. In the Armsby standards, true protein is used instead of crude protein. Digestible crude protein is given here for comparison with the Morrison Modified Wolff-Lehmann Standards.

The average daily gain per steer in all of the trials, except the last, increased consistently with the corn used in the ration. In each of the first three lots the largest daily gains were made in 1920-21. The total dry matter and total nutrients in the ration that year, as well as the net energy values, were a little less than in 1916, and 1917, and the total dry matter and total nutrients, as well as the net energy requirements per cwt. of gain, were less than for either of the other trials. The average weight of the steers used in lots I, II, and III in 1916-17 was heavier by only about five pounds than that of those in 1920-21, while in 1916-17 the length of the trial was one hundred and twenty days, and in 1921 it was one hundred and fourteen days. The apparent difference in economy of gain these two years may have been due to a difference in the moisture content of the corn silage, or to a difference in methods of handling prior to the beginning of the feeding trials.

In each of the lots the dry matter in the ration, as well as the total nutrients and net energy values, were least in 1918-19, when economical gains were made from the standpoint of total nutrients per cwt. of gain. This was due to the use that year of younger and lighter cattle than were used either of the other years. The nutritive ratios widened consistently as corn was added or increased in the ration, varying from 1:3.67 for lot I in 1920-21 to 1:7.93 for lot IV in 1916-17. No harmful effect was noted from the use of the narrow rations in lot I, the economy of gains from the standpoint of total nutrients and net energy requirements usually increasing with the digestible crude protein in the ration. (This, however, may be partly due to the stimulating effect of cottonseed meal for short periods.)

Due to the higher finish the per cent of shrink was usually lower in the lots receiving the medium or heavy corn rations than in the cottonseed meal and light corn lots.

Except in 1920 when lots I and II sold for the same price per cwt., and in 1920-21 when economic conditions were extremely unfavorable to the finishing of cattle the margin between the cost price per cwt. in the feed lot and the selling price per cwt. on the market increased with the increased amount of corn fed.

TABLE XVIII. SUMMARY OF FOUR TRIALS WITH COTTONSEED MEAL, AND COTTONSEED MEAL AND VARYING PROPORTIONS OF CORN FOR FATTENING BEEF STEERS

Total Number of Steers Used---136
Breeding---Angus, Hereford, and Shorthorn Grades
Age---Yearlings and Two-year Olds
Quality---Good to Choice

RATION	LOT I C.S.M. Silage	LOT II C.S.M Silage Light Corn Ration.	LOT III C.S.M Silage Medium Corn Ration.	LOT IV C.S.M Silage Heavy Corn Ration.
Number of steers used	37	36	36	27
Average length of feeding period (days)	122.	122.	122.	124.
Initial weight of steers, total (lbs.)	28671.	27832.7	28092.3	20419.
Average initial weight of steers (lbs.)	774.9	773.1	780.3	756.3
Final weight of steers, total (lbs.)	37704.3	37461.	38531.	28406.6
Average final weight of steers (lbs.)	1019.	1040.6	1070.3	1052.1
Total gain (lbs.)	9033.3	9628.3	10438.7	7987.6
Average gain per steer (lbs.)	244.1	267.5	290.	295.8
Average daily gain per steer (lbs.)	2.	2.19	2.38	2.39
Weight of steers at market, total (lbs.)	35608.4	35188.4	36402.	27257.2
Average weight of steers at market (lbs.)	962.4	977.5	1011.2	1009.5
Shrink, total (lbs.)	2095.9	2272.6	2129.	1149.4
Average shrink per steer (lbs.)	56.6	63.1	59.1	42.6
Percent. of shrink	5.56	6.07	5.53	4.05
Feed consumed, total				
Cottonseed meal (lbs.)	24546.	20350.	16805.	9448.
Shelled corn (lbs.)		19397.	38889.	41711.8
Corn silage (lbs.)	221439.	181417.	161940.	96498.
Average feed consumed per steer				
Cottonseed meal (lbs.)	663.4	565.28	466.8	349.9
Shelled corn (lbs.)		538.8	1080.3	1544.9
Corn silage (lbs.)	5984.8	5039.4	4498.3	3574.
Average daily ration				
Cottonseed meal (lbs.)	5.44	4.63	3.83	2.82
Shelled corn (lbs.)		4.42	8.85	12.46
Corn silage (lbs.)	49.05	41.31	36.87	28.82
Feed consumed per cwt. of gain				
Cottonseed meal (lbs.)	271.7	211.4	161.	118.3
Shelled corn (lbs.)		201.46	372.5	522.2
Corn silage (lbs.)	2451.4	1884.2	1551.	1208.
Selling price of cattle per cwt.	$ 10.36	$ 10.55	$ 10.83	$ 12.38*
Margin received**	2.47	2.62	2.92	4.16
Dressing per cent. based on home weight	51.39	51.74	52.86	55.15
Shipping and selling expense per cwt.†	.50	.49	.49	.48
Pork per lot, credited to steers (lbs.)	17.5	728.	1539.	1474.
Pork credited per steer (lbs.)		20.2	42.8	54.6
Pork credited per 100 lbs. gain made by steers		7.56	14.74	18.45

*Lot IV was dropped the last year of the experiment and therefore these data for this lot are not strictly comparable with those for the other lots.

†Shipping and selling expense per cwt. is based on the home weight.

**The margin as here given is the difference between the cost price per cwt. in the feed lot and the selling price per cwt. on the market

The average initial weights of the steers used in the four lots were very close with the exception of those in Lot IV. The average weight of steers in lot IV was lower than in the other lots due to the fact that his lot was dropped the last year of the experiment, when the average weights of the cattle used were considerably above the average of the first three trials.

The average daily gain per head increased with the increased amount of corn in the ration. The finish was also improved by the use of corn as indicated by the selling price per cwt. of the steers and by the dressing per cent.

The selling price per cwt. correlated rather closely with the dressing per cent. The selling price per cwt. and the margin between the cost and selling price per cwt. for lot IV are not strictly comparable with these data for the other lots, as lot IV was dropped the last year of the experiment, when a

margin of only forty cents was received on the lots fed. This reduced the selling price and margin on lots I, II, and III, leaving the figures for lot IV disproportionately high.

The per cent of shrink from the feed lot to market in the different lots was smallest in lot IV and greatest in lot II. It was lighter in lots III and IV where the steers showed higher finish than in lots I and II, which carried a less finish.

The shipping expense, based on home weights was approximately fifty cents per cwt. Based on market weights, it would have run somewhat higher.

The amount of pork produced in the lots, which could be credited to the cattle, was dependent upon the amount of corn used in the ration. In lot I, it will be noted that the total amount of pork produced was only 17.5 pounds indicating that it is not practical to follow cattle with hogs where only cottonseed meal and silage are fed. The pork credited per steer in lots II, III and IV increased in proportion to the corn in the ration, varying from 20.2 pounds per steer in lot II to 54.6 pounds in lot IV. From these data it is evident that when corn is fed hogs should be used to follow the steers.

The dry matter and the total digestible nutrients in the ration* were lowest in lot I and highest in lot IV, increasing as the per cent of corn was increased. The dry matter consumed per hundred pounds of gain was smallest in lot II and greatest in lot I, while the total digestible nutrients per cwt. of gain was smallest in lot I and greatest in lot IV, increasing as corn was added. The nutritive ratio varied from 1:4.07 in lot I to 1:6.83 in lot IV, widening as the per cent of corn was increased. The net energy values of the rations used increased as corn was added, as did the net energy values per cwt. of gain.

During the period of these trials, fluctuations in feed and cattle prices made the fattening of steers more or less hazardous from a financial standpoint, especially when both cattle and feeds were purchased or charged at market prices. These conditions, however, were not peculiar to Mississippi as they prevailed generally over the entire country. Where cattle and feeds are grown by the feeder, the speculation in fattening steers is greatly reduced. By using feed and cattle prices, based on the average for ten years, a more accurate estimate may be obtained of the financial side of cattle feeding and one more favorable to the industry.

The following tabulation, based on the preceding summary, shows the cost of one hundred pounds of gain with the prices of corn and cottonseed meal as shown at the left, and the prices of silage as given at the top of the table.

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*The total dry matter and total nutrients in the rations, the total dry matter and nutrients per cwt. of gain, the nutritive ratios, and the net energy values both of the rations and per cwt. of gain are given in table IV. These data are based on calculations using the percentages given in table III, Appendix, Feeds and Feeding, by Henry and Morrison.

TABLE XIX. COST OF ONE HUNDRED POUNDS GAIN IN THE SEVERAL LOTS WITH VARYING PRICES OF COTTONSEED MEAL, CORN, AND SILAGE.

Price		Silage $4.00 per ton				Silage $5.00 per ton			
C. S. M. per ton. $	Corn per Bu., Cts.	Lot No. I C.S.M. Silage	Lot No. II C.S.M. Silage Light Corn Ration.	Lot No. III C.S.M. Silage Medium Corn Ration.	Lot No. IV C.S.M. Silage Heavy Corn Ration.	Lot No. I C.S.M. Silage	Lot II C.S.M. Silage Light Corn Ration.	Lot No. III C.S.M. Silage Medium Corn Ration.	Lot No. IV C.S.M. Silage Heavy Corn Ration.
25.00	45.	$8.30	$ 8.03	$ 8.11	$ 8.09	$9.52	$ 8.97	$ 8.88	$ 8.70
"	47.5		8.12	8.27	8.32		9.06	9.05	8.93
"	50.		8.21	8.44	8.56		9.15	9.22	9.16
"	52.5	Cost not	8.30	8.61	8.79	Cost not	9.24	9.38	9.39
"	55.	affected	8.39	8.77	9.02	affected	9.33	9.55	9.63
"	57.5	by price	8.48	8.94	9.26	by price	9.42	9.71	9.86
"	60.	of corn.	8.57	9.11	9.49	of corn.	9.51	9.88	10.09
"	62.5		8.66	9.27	9.72		9.60	10.05	10.33
27.50	47.5	$8.64	8.38	8.48	8.47	$9.86	9.33	9.25	9.08
"	50.		8.47	8.64	8.71		9.42	9.42	9.31
"	52.5		8.56	8.81	8.94		9.51	9.58	9.54
"	55.	Cost not	8.65	8.97	9.17	Cost not	9.60	9.75	9.78
"	57.5	affected	8.74	9.14	9.40	affected	9.69	9.92	10.01
"	60.	by price	8.83	9.31	9.64	by price	9.78	10.08	10.24
"	62.5	of corn.	8.92	9.47	9.87	of corn.	9.87	10.25	10.47
"	65.		9.01	9.64	10.10		9.96	10.41	10.71
30.00	50.	$8.98	8.74	8.84	8.85	$10.20	9.68	9.62	9.46
"	52.5		8.83	9.01	9.09		9.77	9.78	9.69
"	55.		8.92	9.18	9.32		9.86	9.95	9.92
"	57.5	Cost not	9.01	9.34	9.55	Cost not	9.95	10.12	10.16
"	60.	affected	9.10	9.51	9.79	affected	10.04	10.28	10.39
"	62.5	by price	9.19	9.67	10.02	by price	10.13	10.45	10.62
"	65.	of corn.	9.28	9.84	10.25	of corn.	10.22	10.62	10.86
"	67.5		9.37	10.01	10.48		10.31	10.78	11.09
32.50	50.	$9.32	9.00	9.04	9.00	10.54	9.94	9.82	9.60
"	52.5		9.09	9.21	9.23		10.03	9.99	9.84
"	55.		9.18	9.38	9.47		10.12	10.15	10.07
"	57.5	Cost not	9.27	9.54	9.70	Cost not	10.21	10.32	10.30
"	60.	affected	9.36	9.71	9.93	affected	10.30	10.48	10.54
"	62.5	by price	9.45	9.88	10.17	by price	10.39	10.65	10.77
"	65.	of corn.	9.54	10.04	10.40	of corn.	10.48	10.82	11.00
"	67.5		9.63	10.21	10.63		10.57	10.98	11.24
35.00	52.5	$9.66	9.36	9.41	9.38	$10.88	1030	10.19	9.99
"	55.		9.45	9.58	9.62		10.39	10.35	10.22
"	57.5	Cost not	9.54	9.74	9.85	Cost not	10.48	10.52	10.45
"	60.	affected	9.63	9.91	10.08	affected	10.57	10.69	10.69
"	62.5	by price	9.72	10.08	10.31	by price	10.66	10.85	10.92
"	65.	of corn.	9.81	10.24	10.55	of corn.	10.75	11.02	11.15
"	67.5		9.90	10.41	10.78		10.84	11.18	11.38
"	70.		9.99	10.58	11.01		10.93	11.35	11.62
37.50	55.	$10.00	9.71	9.78	9.76	$ 11.22	10.65	10.55	10.37
"	57.5		9.80	9.95	10.00		10.74	10.72	10.60
"	60.	Cost not	9.89	10.11	10.23	Cost not	10.83	10.89	10.83
"	62.5	affected	9.98	10.28	10.46	affected	10.92	11.05	11.07
"	65.	by price	10.07	10.44	10.70	by price	11.01	11.22	11.30
"	67.5	of corn.	10.16	10.61	10.93	of corn.	11.10	11.39	11.53
"	70.		10.25	10.78	11.16		11.19	11.55	11.77
"	72.5		10.34	10.94	11.39		11.28	11.72	12.00
40.00	57.5	$10.34	10.06	10.15	10.14	$ 11.56	11.01	10.92	10.75
"	60.		10.15	10.31	10.38		11.10	11.09	10.98
"	62.5		10.24	10.48	10.61		11.19	11.25	11.21
"	65.	Cost not	10.33	10.65	10.84	Cost not	11.28	11.42	11.45
"	67.5	affected	10.42	10.81	11.08	affected	11.37	11.59	11.68
"	70.	by price	10.51	10.98	11.31	by price	11.46	11.75	11.91
"	72.5	of corn.	10.60	11.14	11.54	of corn.	11.55	11.92	12.15
"	75.		10.69	11.31	11.78		11.64	12.09	12.38
"	77.5		10.78	11.48	12.01		11.73	12.25	12.61
"	80.		10.87	11.64	12.24		11.82	12.42	12.85
42.50	60.	$10.68	10.42	10.51	10.52	$11.90	11.36	11.29	11.13
"	62.5		10.51	10.68	10.76		11.45	11.46	11.36
"	65.		10.60	10.85	10.99		11.54	11.62	11.60
"	67.5	Cost not	10.69	11.01	11.22	Cost not	11.63	11.79	11.83
"	70.	affected	10.78	11.18	11.46	affected	11.72	11.95	12.06
"	72.5	by price	10.87	11.35	11.69	by price	11.81	12.12	12.29
"	75.	of corn.	10.96	11.51	11.92	of corn.	11.90	12.29	12.53
"	77.5		11.05	11.68	12.16		11.99	12.45	12.76
"	80.		11.14	11.84	12.39		12.08	12.62	12.99
"	82.5		11.23	12.01	12.62		12.17	12.79	13.23
"	85.		11.32	12.18	12.86		12.26	12.95	13.46

TABLE XIX—Continued

Price		Silage $4.00 per ton				Silage $5.00 per ton			
C. S. M. per ton, $	Corn per bu., Cts.	Lot No. I C.S.M. Silage	Lot No. II C.S.M. Silage Light Corn Ration	Lot No. III C.S.M. Silage Medium Corn Ration	Lot No. IV C.S.M. Silage Heavy Corn Ration	Lot No. I C.S.M. Silage	Lot No. II C.S.M. Silage Light Corn Ration.	Lot No. III C.S.M. Silage Medium Corn Ration.	Lot No. IV C.S.M. Silage Heavy Corn Ration.
45.00	60.	$11.02	$ 10.68	$ 10.72	$ 10.67	$12.24	$ 11.63	$ 11.49	$ 11.28
"	62.5		10.77	10.88	10.91		11.72	11.66	11.51
"	65.		10.86	11.05	11.14		11.81	11.82	11.74
"	67.5		10.95	11.21	11.37		11.90	11.99	11.98
"	70.	Cost not	11.04	11.38	11.61	Cost not	11.99	12.16	12.21
"	72.5	affected	11.13	11.55	11.84	affected	12.08	12.32	12.44
"	75.	by price	11.22	11.71	12.07	by price	12.17	12.49	12.68
"	77.5	of corn.	11.31	11.88	12.30	of corn.	12.26	12.66	12.91
"	80.		11.40	12.05	12.54		12.34	12.82	13.14
"	82.5		11.49	12.21	12.77		12.43	12.99	13.37
"	85.		11.58	12.38	13.00		12.52	13.15	13.61
"	87.5		11.67	12.54	13.24		12.61	13.32	13.84
47.50	62.5	$ 11.36	11.04	11.08	11.05	$12.58	11.98	11.86	11.66
"	65.		11.13	11.25	11.29		12.07	12.02	11.89
"	67.5		11.22	11.42	11.52		12.16	12.19	12.12
"	70.		11.31	11.58	11.75		12.25	12.36	12.36
"	72.5		11.40	11.75	11.99		12.34	12.52	12.59
"	75.	Cost not	11.49	11.91	12.22	Cost not	12.43	12.69	12.82
"	77.5	affected	11.58	12.08	12.45	affected	12.52	12.86	13.06
"	80.	by price	11.67	12.25	12.69	by price	12.61	13.02	13.29
"	82.5	of corn.	11.76	12.41	12.92	of corn.	12.70	13.19	13.52
"	85.		11.85	12.58	13.15		12.79	13.36	13.76
"	87.5		11.94	12.75	13.39		12.88	13.52	13.99
"	90.		12.03	12.91	13.62		12.97	13.69	14.22
50.00	65.	$11.70	11.39	11.45	11.43	$12.92	12.33	12.23	12.04
"	67.5		11.48	11.62	11.67		12.42	12.39	12.27
"	70.		11.57	11.78	11.90		12.51	12.56	12.51
"	72.5		11.66	11.95	12.13		12.60	12.73	12.74
"	75.		11.75	12.12	12.37		12.69	12.89	12.97
"	77.5	Cost not	11.84	12.28	12.60		12.78	13.06	13.20
"	80.	affected	11.93	12.45	12.83	Cost not	12.87	13.22	13.44
"	82.5	by price	12.02	12.61	13.07	affected	12.96	13.39	13.67
"	85.	of corn.	12.11	12.78	13.30	by price	13.05	13.56	13.90
"	87.5		12.20	12.95	13.53	of corn.	13.14	13.72	14.14
"	90.		12.29	13.11	13.77		13.23	13.89	14.37
"	92.5		12.38	13.28	14.00		13.32	14.06	14.60
"	95.		12.47	13.45	14.23		13.41	14.22	14.84
"	97.5		12.56	13.61	14.47		13.50	14.39	15.07
"	100.		12.65	13.78	14.70		13.59	14.55	15.30
52.52	70.	$12.03	11.84	11.98	12.05	$13.26	12.78	12.76	12.65
"	72.5		11.93	12.15	12.28		12.87	12.93	12.89
"	75.		12.02	12.32	12.52		12.96	13.09	13.12
"	77.5		12.11	12.48	12.75		13.05	13.26	13.35
"	80.		12.20	12.65	12.98		13.14	13.43	13.59
"	82.5		12.29	12.82	13.21		13.23	13.59	13.82
"	85.	Cost not	12.38	12.98	13.45	Cost not	13.32	13.76	14.05
"	87 5	affected	12.47	13.15	13.68	affected	13.41	13.92	14.28
"	90.	by price	12.56	13.31	13.91	by price	13.50	14.09	14.52
"	92.5	of corn.	12.65	13.48	14.15	of corn.	13.59	14.26	14.75
"	95.		12.74	13.65	14.38		13.68	14.42	14.98
"	97.5		12.83	13.81	14.61		13.77	14.59	15.22
"	100.		12.92	13.98	14.85		13.86	14.76	15.45
"	102.5		13.01	14.15	15.08		13.95	14.92	15.68
55.00	72.5	$12.37	12.19	12.35	12.43	$13.60	13.13	13.13	13.03
"	75.		12.28	12.52	12.66		13.22	13.29	13.27
"	77.5		12.37	12.68	12.90		13.31	13.46	13.50
"	80.		12.46	12.85	13.13		13.40	13.63	13.73
"	82.5		12.55	13.02	13.36		13.49	13.79	13.97
"	85.		12.64	13.18	13.60		13.58	13.96	14.20
"	87.5	Cost not	12.73	13.35	13.83	Cost not	13.67	14.13	14.43
"	90.	affected	12.82	13.52	14.06	affected	13.76	14.29	14.67
"	92.5	by price	12.91	13.68	14.29	by price	13.85	14.46	14.90
"	95.	of corn.	13.00	13.85	14.53	of corn.	13.94	14.62	15.13
"	97.5		13.09	14.01	14.76		14.03	14.79	15.37
"	100.		13.18	14.18	14.99		14.12	14.96	15.60
"	102.5		13.27	14.35	15.23		14.21	15.12	15.83
"	105.		13.36	14.51	15.46		14.30	15.29	16.06

TABLE XIX—Continued

Price		Silage $4.00 per ton				Silage $5.00 per ton			
C. S. M. per Ton. $	Corn per Bu., Cts.	Lot No. I C.S.M. Silage	Lot No. II C.S.M. Silage Light Corn Ration.	Lot No. III C.S.M. Silage Medium Corn Ration.	Lot No. IV C.S.M. Silage Heavy Corn Ration.	Lot No. I C.S.M. Silage	Lot No. II C.S.M. Silage Light Corn Ration.	Lot No. III C.S.M. Silage Medium Corn Ration.	Lot No. IV C.S.M. Silage Heavy Corn Ration.
57.50	75.	$12.71	$ 12.54	$ 12.72	$ 12.81	$13.94	$ 13.49	$ 13.50	$ 13.41
"	77.5		12.63	12.89	13.04		13.58	13.66	13.65
"	80.		12.72	13.05	13.28		13.67	13.83	13.88
"	82.5		12.81	13.22	13.51		13.76	13.99	14.11
"	85.		12.90	13.38	13.74		13.85	14.16	14.35
"	87.5		12.99	13.55	13.98		13.94	14.33	14.58
"	90.	Cost not	13.08	13.72	14.21	Cost not	14.03	14.49	14.81
"	92.5	affected	13.17	13.88	14.44	affected	14.12	14.66	15.05
"	95.	by price	13.26	14.05	14.68	by price	14.21	14.83	15.28
"	97.5	of corn.	13.35	14.22	14.91	of corn.	14.30	14.99	15.51
"	100.		13.44	14.38	15.14		14.39	15.16	15.75
"	102.5		13.53	14.55	15.38		14.48	15.32	15.98
"	105.		13.62	14.72	15.61		14.57	15.49	16.21
"	107.5		13.71	14.88	15.84		14.66	15.66	16.45
60.00	77.5	$13.05	12.90	13.09	13.19	$14.28	13.84	13.86	13.80
"	80.		12.99	13.25	13.43		13.93	14.03	14.03
"	82.5		13.08	13.42	13.66		14.02	14.20	14.26
"	85.		13.17	13.59	13.89		14.11	14.36	14.50
"	87.5		13.26	13.75	14.12		14.20	14.53	14.73
"	90.	Cost not	13.35	13.92	14.36	Cost not	14.29	14.69	14.96
"	92.5	affected	13.44	14.38	15.14	affected	14.38	14.86	15.19
"	95.	by price	13.53	14.25	14.82	by price	14.47	15.03	15.43
"	97.5	of corn.	13.62	14.42	15.06	of corn.	14.56	15.19	15.66
"	100.		13.71	14.58	15.29		14.65	15.36	15.89
"	102.5		13.80	14.75	15.52		14.74	15.53	16.13
"	105.		13.89	14.92	15.76		14.87	15.69	16.36
"	107.5		13.98	15.08	15.99		14.92	15.86	16.59
62.50	80.	13.39	13.25	13.45	13.57	$14.62	14.19	14.23	14.18
"	82.5		13.34	13.62	13.81		14.28	14.40	14.41
"	85.		13.43	13.79	14.04		14.37	14.56	14.64
"	87.5		13.52	13.95	14.27		14.46	14.73	14.88
"	90.		13.61	14.12	14.51		14.55	14.90	15.11
"	92.5	Cost not	13.70	14.29	14.74	Cost not	14.64	15.06	15.34
"	95.	affected	13.79	14.45	14.97	affected	14.73	15.23	15.58
"	97.5	by price	13.88	14.62	15.20	by price	14.82	15.39	15.81
"	100.	of corn.	13.97	14.79	15.44	of corn.	14.91	15.56	16.04
"	102.5		14.06	14.95	15.67		15.00	15.73	16.28
"	105.		14.15	15.12	15.90		15.09	15.89	16.51
"	107.5		14.24	15.28	16.14		15.18	16.06	16.74
"	110.		14.33	15.45	16.37		15.27	16.23	16.97
65.00	85.	$13.73	13.70	13.99	14.19	$14.96	14.64	14.76	14.79
"	87.5		13.79	14.15	14.42		14.73	14.93	15.02
"	90.		13.88	14.32	14.65		14.82	15.10	15.26
"	92.5		13.97	14.49	14.89		14.91	15.26	15.49
"	95.		14.06	14.65	15.12		15.00	15.43	15.72
"	97.5		14.15	15.12	15.90		15.09	15.60	15.96
"	100.		14.24	14.99	15.59		15.18	15.76	16.19
"	102.5	Cost not	14.33	15.15	15.82	Cost not	15.27	15.93	16.42
"	105.	affected	14.42	15.32	16.05	affected	15.36	16.09	16.66
"	107.5	by price	14.51	15.49	16.29	by price	15.45	16.26	16.89
"	110.	of corn.	14.60	15.65	16.52	of corn.	15.54	16.43	17.12
"	112.5		14.69	15.82	16.75		15.63	16.59	17.36
"	115.		14.78	15.98	16.98		15.72	16.76	17.59
"	117.5		14.87	16.15	17.22		15.81	16.93	17.82
"	120.		14.96	16.32	17.45		15.90	17.09	18.05
"	122.5		15.05	16.48	17.68		15.99	17.26	18.29
"	125.		15.14	16.65	17.92		16.08	17.42	18.52

From a study of the preceding tables it will be seen that in small amounts, corn can be substituted for cottonseed meal without increasing the cost of gains at higher prices than in medium amounts, and that it may be substituted in medium amounts at higher prices than in large amounts. It should be borne in mind, however, that the tabulations are based entirely upon what happened in the case of the steers used in these trials and that considerable variation from the figures given may be expected with other bunches of steers handled under other conditions.

The following table shows the maximum price at which corn was substituted for cottonseed meal without increasing the cost of gains per hundred pounds, the price of cottonseed meal being as shown in the left hand column and the price of silage as shown above.

TABLE XX. MAXIMUM PRICE AT WHICH CORN WAS SUBSTITUTED FOR COTTONSEED MEAL IN LOTS II, III AND IV WITHOUT INCREASING COST OF 100 POUNDS OF GAIN.

C. S. M. Ration		SILAGE $4.00 PER TON						SILAGE $5.00 PER TON					
		Lot No. II C.S.M. Silage Light Corn Ration.		Lot No. III C.S.M. Silage Medium Corn Ration.		Lot No. IV C.S.M. Silage Heavy Corn Ration.		Lot No. II C.S.M. Silage Light Corn Ration.		Lot No. III C.S.M. Silage Medium Corn Ration.		Lot No. IV C.S.M. Silage Heavy Corn Ration.	
Price per ton, $	Per lb. cts	Price per lb cts	Bu. $	Price per lb cts	Bu. $	Price per lb cts	Bu. $	Price per lb cts	Bu. $	Price per lb cts	Bu. $	Price per lb cts	Bu. $
25.00	1.250	.937	.525	.855	.479	.843	.472	1.078	.604	.976	.546	.962	.539
27.50	1.375	.975	.546	.892	.500	.880	.493	1.115	.625	1.013	.567	.999	.560
30.00	1.500	1.012	.567	.929	.520	.917	.513	1.153	.646	1.050	.588	1.036	.580
32.50	1.625	1.049	.588	.966	.541	.954	.534	1.190	.667	1.087	.609	1.073	.601
35.00	1.750	1.087	.609	1.004	.562	.990	.555	1.228	.687	1.124	.630	1.109	.621
37.50	1.875	1.124	.630	1.041	.583	1.027	.575	1.265	.708	1.162	.650	1.146	.642
40.00	2.000	1.162	.651	1.078	.604	1.064	.596	1.302	.729	1.199	.671	1.183	.662
42.50	2.125	1.199	.672	1.115	.624	1.100	.616	1.340	.750	1.236	.692	1.220	.683
45.00	2.250	1.237	.692	1.152	.645	1.137	.637	1.377	.771	1.273	.713	1.256	.703
47.50	2.375	1.274	.713	1.189	.666	1.174	.657	1.415	.792	1.310	.734	1.293	.724
50.00	2.500	1.311	.734	1.226	.687	1.211	.678	1.452	.813	1.347	.754	1.330	.745
52.50	2.625	1.349	.755	1.264	.708	1.247	.699	1.490	.834	1.384	.775	1.366	.765
55.00	2.750	1.386	.776	1.301	.728	1.284	.719	1.527	.855	1.422	.796	1.403	.786
57.50	2.875	1.424	.797	1.338	.749	1.321	.740	1.564	.876	1.459	.817	1.440	.806
60.00	3.000	1.461	.818	1.375	.770	1.357	.760	1.602	.897	1.496	.838	1.477	.827
62.50	3.125	1.498	.839	1.412	.791	1.394	.781	1.639	.918	1.533	.858	1.513	.847
65.00	3.250	1.536	.860	1.449	.812	1.431	.801	1.677	.939	1.570	.879	1.550	.868
67.50	3.375	1.573	.881	1.486	.832	1.468	.822	1.714	.960	1.607	.900	1.587	.889
70.00	3.500	1.611	.902	1.524	.853	1.504	.842	1.751	.981	1.644	.921	1.623	.909
72.50	3.625	1.648	.923	1.561	.874	1.541	.863	1.789	1.002	1.682	.942	1.660	.930
75.00	3.750	1.686	.944	1.598	.895	1.578	.884	1.826	1.023	1.719	.962	1.697	.950
77.50	3.875	1.723	.965	1.635	.916	1.615	.904	1.864	1.044	1.756	.983	1.734	.971
80.00	4.000	1.760	.986	1.672	.936	1.651	.925	1.901	1.065	1.793	1.004	1.770	.991

Due to the greater margin usually received in the case of corn feeding and to the pork produced behind the steers, corn can be profitably substituted for cottonseed meal in steer rations at prices somewhat higher than those given in the table.

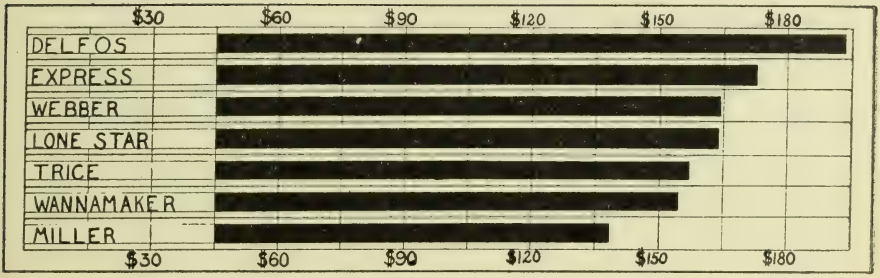
How much the steer feeder can afford to increase the cost of gains by the use of corn will depend largely upon the premium paid for the improvement obtained in finish and to a less extent upon the price received for the pork made after the cattle. Other factors which may influence the price at which corn can be profitably substituted for cottonseed meal in the fattening of steers are the age and quality of the cattle. With younger cattle, it is possible that corn can be profitably substituted at a little higher price than with older animals. It is generally accepted, also, that for cattle of good quality a greater premium may be expected for improvement in finish than with cattle of the cheaper grades.

Bulletin No. 215 January, 1923

COTTON EXPERIMENTS, 1922

DELTA BRANCH STATION

W. E. AYRES



Dollars per Acre for Seed and Lint

Graphic Representation of the total per acre value of seed and lint of seven standard varieties—five year average, 1918-1922

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
J. R. RICKS, Director

STATION STAFF

D. C. HULL, M. Sc. ..... President of College
J. R. RICKS, M. Sc. ..... Director and Chief of Agronomy
E. B. FERRIS, M. Sc. ..... Assistant Director, South Miss. Branch Station
C. T. AMES, M. Sc. ..... Assistant Director, Holly Springs Branch Station
W. E. AYRES, M. Sc. ..... Assistant Director, Delta Branch Station
C. B. ANDERS, B. Sc. ..... Assistant Director, Raymond Branch Station
S. W. GREENE, M. Sc. * ..... In Charge Coastal Plains Branch Station
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R. W. HARNED, B. S. A. ..... Chief in Entomology
K. U. JONES, B. Sc., V. M. D. ..... Veterinarian
C. F. BISCOE, A. M., Ph. D. ..... Bacteriologist
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E. BARNETT ..... Chief in Animal Husbandry
C. J. GOODELL, B. Sc. ..... Animal Husbandman
A. B. McKAY, B. Sc. ..... Chief in Horticulture
J. C. C. PRICE, B. Sc. ..... Horticulturist
D. C. NEAL, B. Sc., M. A. ..... Plant Pathologist
J. N. LIPSCOMB, M. Sc. ..... Farm Management
J. F. O'KELLEY, B. Sc. ..... Plant Breeder
R. N. LOBDELL, M. Sc. ..... Entomologist
H. F. WALLACE, B. Sc. ..... Assistant at Holly Springs Branch Station
F. B. RICHARDSON, B. Sc. ..... Horticulturist, South Miss. Branch Station
M. E. ANDREWS, M. S. A. ..... Associate in Farm Management
H. H. HARNED, M. S. ..... Assistant Bacteriologist
IDE. P. TROTTER, M. Sc. ..... Assistant at Delta Branch Station
MISS KITTIE SUE JOHNSON, A. B. ..... Stenographer and Clerk
D. W. McILWAIN ..... Superintendent of Farm
N. V. EVANS ..... Farm Foreman, South Miss. Branch Station
J. C. RYAN ..... Farm Foreman, Holly Springs Branch Station
K. C. LIVINGSTON ..... Farm Foreman, Delta Branch Station
D. MAXWELL ..... Foreman Horse and Beef Barns
H. B. BROWN, Stoneville ..... Collaborator
E. C. EWING, Scott ..... Collaborator

* In cooperation with Bureau Animal Industry, U. S. Department of Agriculture.

COTTON EXPERIMENTS, 1922

DELTA BRANCH STATION

W. E. AYRES

Since its establishment the Delta Station has devoted the major part of its funds and effort to the study of King Cotton. Cotton is the most profitable crop that can be grown generally in the Delta on well drained soils, but provisions should certainly be made on every plantation to produce feed at home. The lesson of 1920 should never be forgotten. No planter should ever be so thoughtless as to put all his eggs in one basket again.

Fertile soil, a full stand, thorough cultivation, good seed of a good variety, a good seed bed, and many other factors must be used if profit is to be the product, even in the Delta.

VARIETIES

Station Tests: Every year for the past 12 years the Station has tested all varieties thought to have merit for use on Delta plantations. Table I shows the total per acre value of seed and lint for 10 years of 7 standard varieties which have been and are being largely grown in the Delta. From the standpoint of money value for the past 5 years Delfos has averaged 12% better than Express, 17.7% better than Webber, 17.9% better than Lone Star, 23.1% better than Trice, 25.2% better than Wannamaker, and 39.8% better than Miller. For the past 2 years Delfos has been recognized as the most profitable cotton for average Delta conditions, but not until the fall of 1922 has seed of this cotton been available in commercial quantities. The merits and demerits of the 2 most important strains of Delfos are discussed toward the end of this publication in the discussion of Cotton Breeding. For thin warm soils Webber is an excellent cotton but on exceedingly fertile or cold-natured soils earlier varieties are desirable. Of the short cottons Trice and Wannamaker probably deserve most consideration.

TABLE I. Dollars per Acre for Seed and Lint of Standard Varieties Data for Each Year and Average for Last Ten and Five Years

Year	Express	Delfos	Webber	Lone Star	Wannamaker Cleveland	Trice	Miller
1913	122.12	105.81	110.28	106.62	129.02	104.88	117.02
1914	26.29	13.50	13.54	19.58	17.43	23.27	19.57
1915	87.04	92.53	73.04	90.46	78.33	75.08	82.56
1916	108.37	86.02	87.59	108.97	85.17	84.95	89.48
1917	291.91	264.99	281.87	256.72	267.75	204.20	218.62
1918	242.52	225.75	222.96	225.59	235.63	188.46	192.93
1919	270.63	279.43	227.40	227.78	218.94	255.28	169.87
1920	97.75	158.87	127.11	123.23	111.78	112.11	121.81
1921	160.39	194.13	168.43	144.83	117.56	125.06	113.93
1922	91.71	108.54	75.52	98.42	88.56	104.25	92.96
10Yr.Av	149.87	165.10	151.03	157.87	150.70	127.82	121.85
5Yr.Av	172.60	193.35	164.28	163.97	154.49	157.05	138.30

In 1922 several tests were conducted in the various parts of the Delta. Results of these tests are given in detail in tables 5, 7, and 8. Table 2 is a compilation of monetary results of all 1922 tests. It is interesting to note that in this comparison of 20 varieties and strains Delfos 6102 has yielded seed and lint worth more than that of any other variety or strain. Lone Star 65, in 5 tests, only lacked $2.83 per acre of equalling 6102 in money value. Delfos 631, in 15 tests, lacked $6.95 per acre of producing as well as 6102. With these 2 exceptions Delfos 6102 outranked all varieties and strains by a considerable margin. In the 20 comparisons of average results Express 350 was better than 11 strains with which it was compared and poorer than 8. Deltatype Webber in the 20 comparisons was better than 3 strains and poorer than the other 16.

TABLE II. Average per Acre Values of Varieties in 11 Tests Compared with Three Standard Varieties in Same Tests (1)

Variety	No. Tests	Average Total per A. Value	Av. Total per A. Value Other Varieties in Same Tests		
			Delfos 6102	Express 350	Deltatype Webber
Acala 5	3	99.34	130.32	100.68	101.09
Cleveland Wannamaker	2	101.26	133.08	109.00	89.37
Cleveland Piedmont	2	101.26	133.08	109.00	89.37
Cleveland 54	5	111.43	137.50	115.86	107.43
Delfos 120	4	111.03	147.51	117.28	124.07
Delfos 6102	18	137.01	Same	114.61	106.90
Delfos 631	15	127.57	134.52	118.09	104.67
Express Lightning	16	118.77	140.17	117.79	106.81
Express 350	18	114.61	137.01	Same	106.90
Express 630	4	97.26	125.29	97.93	105.08
Express 782	15	107.84	136.32	114.42	105.52
Express Walcott	2	94.86	110.88	90.24	83.35
Express 432	13	124.57	143.31	120.32	110.25
Haaga	10	100.94	128.76	112.08	92.97
Lone Star 65	5	119.14	122.97	98.84	103.46
Sunpress 61	13	119.23	143.91	120.06	113.23
Salsbury	11	122.66	141.32	115.53	105.62
Miss. Station Trice	6	114.58	133.44	111.34	105.91
Webber 49-4-6	9	104.39	130.94	117.01	96.34
Webber-Deltatype	18	106.90	137.01	114.61	Same

(1) Explanation of Table: Acala 5 was in 3 tests with an average value of $99.34. In the same 3 tests Delfos 6102 averaged $130.22; Express 350, $100.68; and Deltatype, $101.09. Delfos 631 was in 15 tests with an average of $127.57. In the same 15 tests Delfos 6102 averaged $134.52; Express 350, $118.09; and Deltatype, $104.67. It will be noted that every variety is compared with Delfos 6102, Express 350, and Deltatype Webber in all tests in which the variety occurred.

Table 3 is a compilation of the lint yield of 20 varieties and strains in all 1922 tests. The premium on staple has been small for the crop of 1922. This has made staple cotton less profitable, comparatively, than in former years and there is, at the present time, a tendency on the part of many staple producers to plant short cottons in 1923. It is necessary that the percentage of the crop planted to staples be reduced but it is doubtful if it will pay the average Delta planter to go to short cottons on Delta soils. A study of table 3 tends to discourage the growth of short cotton under average Delta conditions. Probably the hill farmer should be the first to desert staples. Table

3 shows that only one short variety has averaged more lint in the Delta than Delfos 6102 in 1922. The Delta planter should study this table carefully before buying seed of short cotton for 1923 planting.

TABLE III. Average Pounds of Lint per Acre of Varieties in All Tests Compared with Three Standard Varieties in Same Tests (1)

Variety	No. Tests	Av. No. Lbs. of Lint per Acre	Av. Lbs. of Lint per A. Other Varieties in Same Tests		
			Delfos 6102	Express 350	Deltatype Webber
Acala 5	3	364.5	419.9	318.0	313.6
Cleveland-Wannamaker	2	408.4	422.4	307.6	270.5
Cleveland-Piedmont	2	408.4	422.4	307.6	270.5
Cleveland 54	5	469.0	454.2	375.4	317.0
Delfos 120	4	364.4	485.5	374.2	314.0
Delfos 631	15	398.7	430.6	371.7	314.0
Delfos 6102	18	425.9	Same	359.3	320.7
Express 350	18	359.3	426.0	Same	320.7
Express-Lightning	16	370.4	435.5	369.9	319.1
Express 630	4	304.2	400.4	307.0	326.2
Express 782	15	344.1	417.5	354.8	318.5
Express-Walcott	2	296.8	348.9	279.6	252.9
Express 432	13	409.9	440.0	374.5	328.4
Haaga	10	297.9	383.0	345.7	277.7
Lone Star 65	5	401.6	401.0	316.6	319.9
Sunpress 61	13	335.1	445.3	377.0	339.2
Salsbury	11	404.6	426.9	358.1	317.9
Miss. Station Trice	6	434.0	438.0	358.7	314.0
Webber 49-4 and 6	9	319.5	412.3	363.7	290.0
Webber-Deltatype	18	320.7	426.0	359.3	Same

(1) Explanation of Table: Acala was in 3 tests with an average of 364.5 pounds. In the same 3 tests Delfos 6102 averaged 419.9 pounds; Express 350, 318.0 pounds; Deltatype Webber, 313.6 pounds. Delfos 631 was in 15 tests with an average of 398.7 pounds. In the same 15 tests Delfos 6102 averaged 425.9 pounds; Express 350. 359.3 pounds; and Deltatype Webber, 320.7 pounds. It will be noted that every variety is compared with Delfos 6102, Express 350, and Deltatype Webber in all the tests in which the variety occurred.

The introduction of short cotton into established staple areas is objectionable for many reasons, even if immediate per acre remuneration is as good for short cotton as for staple varieties. Short varieties become mixed, at the gin, in the field, and otherwise, with established staple strains in the community. The standard of all the cotton in the community is thus lowered. If, during any one year, considerable short cotton is shipped from any established staple area, that area loses its staple reputation in the markets. The labor disturbance caused by growing short cotton periodically is no small consideration.

Table 4 shows data for variety tests conducted at the Station in 1922. Four series of plots of each tests were planted April 21. All varieties came up to a good stand. Heavy rains, hot sun, and cool nights so reduced the stand on some varieties that results are not as reliable as is desirable for definite conclusions. Results are based on an average stand of plants after due allowance is made for advantage gained by plants adjacent to skips. Results of any first picking are misleading, since thin hulled varieties will open quicker than thick hulled ones, even if the bolls are set the same day. For this reason, publishing first picking data has been discontinued. The values and

lint produced under such heavy weevil infestation as prevailed in 1922 determine whether or not a variety is early and prolific.

In the test of standard varieties Delfos 6102 ranked 1st; Cleveland 54, 2nd; Half and Half, 3rd; Miss. Station Trice, 4th; and Delfos 631, 5th. The difference in per acre value of the products of Delfos 6102 and 631 was only $4.83. The difference between the best and poorest varieties was $40.12 per acre or 58.6%. The 5 high yielders averaged $32.08 per acre or 43 8% more than the 5 low ones.

TABLE IV. Station Variety Tests

Variety	Pounds per Acre		Per Acre Value of Seed and Lint			Length Lint Inches	Per Cent Lint	No. Bolls per Lb.
	Seed Cotton	Lint	Dollars 1922	Rank	Av. Dollars 1921-22			
First Test—Standard Varieties								
Miss. Station Trice	1171.6	351.4	104.25	4	114.65	1 1-16	30.1	86
Cleveland-Wannamaker	892.4	332.8	88.56	15	103.06	3-4	37.3	75
Cleveland-Piedmont	983.7	344.4	95.44	9	106.30	15-16	34.0	77
Cleveland 54	1069.6	381.8	105.38	2	113.10	15-16	35.7	74
Half & Half	946.0	414.3	104.87	3	106.44	5-8	43.8	72
Cook 588	739.0	274.1	75.00	19	89.87	7-8	37.1	69
Miller	964.9	320.3	92.96	10	103.44	1 1-16	33.2	58
Acala 5	767.2	273.1	78.16	17	100.13	1 1-16	35.6	72
Lone Star 79	955.5	292.3	92.18	11	117.55	1 1-18f	30.6	74
Lone Star 65	987.6	321.9	98.42	8	121.62	1 1-8	32.9	63
Salsbury	743.2	243.7	74.56	20	111.82	1 1-8	32.8	82
Webber 49-4	766.8	231.5	75.52	18	109.95	1 1-4s	30.2	78
Webber-Deltatype	678.9	207.0	68.42	22	118.42	1 1-4	30.5	80
Sunpress 61	954.2	252.8	88.60	14	130.67	1 5-16	26.5	85
Delfos 631	1020.5	320.4	103.71	5	145.01	1 1-4s	31.4	77
Delfos 698	996.6	323.8	102.49	7	137.38	1 3-16	32.5	73
Delfos 6102	1082.0	340.8	108.54	1	151.33	1 3-16	31.5	84
Express-Walcott	1058.7	320.7	102.95	6	131.87	1 3-16	30.3	67
Express 782	782.6	228.7	72.87	21	116.63	1 3-16	31.4	84
Express-Lightning	986.7	284.1	92.17	12	120.13	1 3-16	28.8	77
Express 630	836.4	249.2	80.27	16	110.38	1 3-16	29.8	82
Express 350	997.2	284.2	91.71	13	110.76	1 3-16s	28.5	86
Second Test—New and Miscellaneous Cottons								
Miss. Station Trice	1264.9	380.7	112.86	5		1 1-16	30.1	83
Trice-Burdette	977.3	295.1	87.42	19		1 1-16	30.2	79
Lone Star 65	1183.9	385.9	118.22	2		1 1-8	32.6	60
Lone Star 79	1037.9	315.5	99.63	9		1 1-8f	30.4	71
Lone Star 5-Burdette	1221.0	388.2	118.54	1		1 1-8	31.8	72
Acala 5-Nunn	884.8	312.5	89.52	17		1 1-16	35.3	69
Acala 5-Russell-Heckle	903.1	321.5	92.00	14		1 1-16	35.6	61
Acala 25-Burdette	1213.0	431.8	105.91	5		1 1-16f	35.6	61
Delfos 698	1165.4	283.4	95.57	12		1 3-16	32.9	75
Delfos 6102	1109.0	357.0	113.21	3		1 3-16	32.3	86
Delfos 120	825.4	243.4	78.57	25		1 3-16	29.5	82
Delfos 91	1026.7	326.4	103.77	8		1 3-16	31.9	72
Delfos 631	955.0	298.9	96.81	11		1 1-4s	31.3	72
Webber 49-4	810.4	237.4	77.93	26		1 1-4s	29.3	77
Haaga	762.0	226.0	74.06	28		1 1-4s	29.7	81
Express-Walcott	897.8	272.9	86.85	20		1 3-16s	30.4	64
Express 11-Walcott	926.8	281.8	89.69	16		1 3-16s	30.4	62
Express 782	755.4	237.1	74.96	27		1 3-16s	31.4	78
Express-McLendon	885.9	266.7	83.06	24		1 1-8	30.1	81
Express 79	1128.5	322.7	104.84	6		1 3-16	28.6	84
Express-Marshall	1108.2	324.7	104.14	7		1 3-16s	29.3	81
Express-Ewing	901.7	269.6	86.78	21		1 3-16	29.9	82
Express 630	892.6	265.9	84.97	22		1 3-16s	29.8	76
Express 344-1	985.8	288.8	92.64	13		1 3-16s	29.3	75

TABLE V. Cooperative Tests—Bolivar County

Variety	Lbs. per Acre		Per Acre Value		Lbs. per Acre		Per Acre Value	
	Seed Cotton	Lint	Dollars	Rank	Seed Cotton	Lint	Dollars	Rank
	H. Y. Jumper, Dahomy Typical Buckshot Soil				J. H. Pace, Buckshot Soil			
ghtning Express	1197.4	346.0	112.20	5	876.0	229.7	74.38	6
xpress 350	1282.4	356.5	116.55	4	868.5	241.4	78.94	8
xpress 432	1106.9	354.2	108.92	6	852.9	272.9	83.92	3
xpress 782	1063.8	340.4	108.09	7	810.4	259.3	82.33	4
npress 61	1139.9	296.3	104.30	8				
elfos 6102	1355.6	417.5	133.58	1	990.5	305.1	97.62	1
elfos 631	1331.1	403.3	131.48	2				
eltatype Webber	1090.3	300.9	101.54	9	821.9	226.8	76.55	9
aaga	908.1	266.0	87.34	13	851.0	249.3	81.84	5
ebber 49-6B	1039.1	303.4	99.67	10	767.9	224.2	73.76	12
artsville 16	972.3	278.0	91.74	11	799.6	228.6	75.43	10
lsbury	1207.6	392.4	120.20	3	955.3	310.4	95.16	2
wing Express	935.3	276.8	98.30	12	839.7	248.5	80.17	7
olk					789.5	229.7	74.38	11
	O. O. Wolf, Duncan Buckshot Soil				J. W. Bishop, Shaw Buckshot Soil			
ghtning Express	822.3	237.6	77.05	7	1501.1	433.8	140.06	5
xpress 432	782.8	250.4	77.03	8	1556.9	498.2	158.17	3
xpress 782	812.8	260.0	82.67	4	1282.4	410.3	130.30	8
olk	735.0	213.8	69.24	11				
elfos 6102	938.1	288.9	92.44	1	1734.0	534.0	170.85	9
elfos 631	812.8	246.8	80.29	5	1671.6	506.5	164.12	2
eltatype Webber	768.7	212.1	71.60	10	1052.7	290.5	197.05	12
aaga	748.4	219.2	71.98	9	1175.4	344.4	113.06	11
ebber 49-6B	832.9	243.2	79.89	6	1181.3	344.9	113.31	10
artsville 16	670.8	191.7	63.30	12	1311.1	375.0	123.72	9
lsbury	894.4	290.6	89.10	2	1329.3	435.2	133.23	5
wing Express	882.9	261.3	84.30	3	1329.8	412.2	132.98	7
xpress 350					1646.8	457.8	149.69	4
npress 61					1381.6	359.2	126.41	9
	A. W. Wooten, Shelby Loamy Buckshot Soil				J. L. Smith, Cleveland Loamy Soil			
ghtning Express	1396.4	388.9	127.11	8	1570.5	453.9	147.14	3
xpress 350	1435.1	498.9	155.93	1	1469.2	415.9	135.44	6
xpress 432	1471.3	470.8	144.80	4	1248.1	399.4	122.81	10
xpress 782	1189.3	380.6	120.83	10	1220.2	390.5	123.97	9
npress 61	1428.6	371.4	130.71	6	1272.5	330.8	109.81	14
elfos 6102	1366.7	520.9	134.70	5	1621.7	499.5	162.30	1
elfos 631	1275.1	371.2	122.00	9	1557.7	471.9	155.86	2
eltatype Webber	1269.9	350.5	118.16	11	1209.9	356.3	119.55	11
aaga	1347.7	394.8	128.66	7	1305.9	382.6	125.60	8
ebber 49 6B	1182.9	345.4	113.47	12	1490.5	435.2	143.00	4
artsville 16	1420.1	406.1	109.64	13	1261.6	360.8	113.77	13
lsbury	1510.6	490.9	150.50	3	1395.3	441.2	139.70	5
wing Express	1586.1	469.5	151.43	2	1357.6	413.0	133.22	
lumbia					1289.9	374.1	119.31	12
	Will Dockery, Dockery Loam Soil				S. T. Speaks, Benoit, Loam Soil			
rshall Express	1407.9	328.0	111.80	10				
ghtning Express	2091.3	604.3	194.46	3	1358.3	392.6	128.06	6
press 350	1670.4	464.4	151.81	9	1443.5	401.2	131.19	5
press 432	1921.7	612.4	188.19	4	1351.6	432.5	133.00	4
press 782	1784.1	570.9	181.26	6	1018.3	325.8	103.46	9
npress 61	1744.0	452.7	159.29	8				
lfos 6102	2149.9	662.2	211.76	21	1376.2	423.8	134.60	3
ltatype Webber	2198.4	606.8	203.77	2	1040.5	287.2	95.48	10
rtsville 16	1696.5	485.2	160.08	7	1300.2	371.9	122.69	7
lsbury	1823.7	592.7	181.66	5	1625.9	528.4	161.97	1
lfos 631					1219.8	369.6	120.49	8
aga					1412.9	414.0	135.89	2
	J. S. Gortner, Shelby, Loamy Buckshot				G. W. Warfield, Gunnison, Light Buckshot			
ghtning Express	708.5	204.7	66.37	8	1136.6	328.5	106.49	7
press 350	671.5	186.7	61.02	9	1388.4	385.9	126.20	2
press 432	765.7	245.0	75.44	4	1097.9	351.4	108.04	6
press 782	753.0	240.9	76.50	3	1280.9	409.9	130.15	1
npress 61	804.8	209.3	73.64	7	1026.4	266.8	93.90	8
lfos 6102	784.4	241.6	139.02	1	1109.5	341.2	109.32	5
aga	779.9	228.5	75.00	5	1205.9	353.3	115.98	3
rtsville 16	782.7	223.8	73.85	6	734.5	210.0	69.30	9
sbury	777.1	252.5	77.52	2				
ing Express					1212.5	358.9	115.76	4

In the tests of new and miscellaneous cottons Lone Star 5 was 1st; Lone Star 65, 2nd; Delfos 6102, 3rd; Miss. Station Trice, 4th; and Acala 25, 5th. The highest producer was $44.48 per acre or 60.1% better than the poorest yielder. The 5 highest yielders averaged $113.75 per acre and the lowest 5, $77.71. The difference was $36.04 per acre or 46.4%. The value produced by a variety should not be considered alone. If the monetary products of two varieties differ by only a few dollars, such things as boll size and storm resistance will often make the one producing the lower value the more desirable.

TABLE VI. Prices Used in Computing Value of Lint in Preceeding Tables

Length of Lint Inches	Price—Cents per Pound	Length of Lint Inches	Price—Cents per Pound
5-8	22.75	1 1-8	26.50
3-4	23.25	1 5-32	27.00
7-8	23.75	1 3-16	27.50
1 5-16	24.00	1 7-32	28.00
1 1-32	24.75	1 9-32	29.00
1 1-16	25.00	1 5-16	29.50
1 3-32	25.25	1 3-8	30.50

Bolivar County Tests: Ten cooperative tests with a few standard varieties were conducted by C. C. Smith, County Agent, and careful farmers on the important soil types of the county. Results of these tests are published in tables 5 and 6. They should be very interesting to the whole Delta but especially to planters in the immediate vicinity of the tests. Conclusions of Mr. Smith relative to varieties for general use in the county follow:

"From these tests this year, a relatively dry year, Delfos 631, Delfos 6102, Salsbury, Express 432, Express 782, and Lightning Express look like good cotton for buckshot land. For loamy buckshot lands of medium fertility, Salsbury, Express 432, Delfos 6102, and Delfos 631 seem to be good cottons. For loam lands Delfos 6102, Delfos 631, Lightning Express, Salsbury, Express 432, and Deltatype Webber seem to be good. For new grounds Delfos 6102 and Delfos 631 are outstanding cottons. Express 432, Express 350, and Salsbury seem to make good yields.

"From these tests it will be seen that Lightning Express and Express 350 are practically the same. Lightning Express is a fraction of one sixteenth longer, a little more uniform, and has a slightly better lint percentage than 350. The only places for Webber or cottons of that type seem to be thin, quick maturing loams and sandy soils or thin buckshot ridges which do not get weevils too early. The Delfos cottons are probably not adapted to real poor lands without nitrogenous fertilizers, and they are not suited to lands badly infected with cotton wilt."

Mr. Smith's conclusions seem sound when data and observation of this and all previous years are considered. The data are published so that any interested party can do his own figuring and draw his own conclusions.

Length of lint and per cent lint used in computing values in the tests conducted by C. C Smith follow: Lightning Express, 28.9%-1 3-16 in.; Express 350, 27.8%-1 5-32 in.; Sunpress 61, 26%-1 5-16 in.; Delfos 6102, 30.8%-1 3-16 in.; Delfos 631, 30.0%-1 7-32 in.; Deltatype Webber, 27.6%-1 1-4 in.; Haaga, 29.3%-1 7-32 in.; Webber 49-6B-29.2%-1 7-32 in.; Hartsville 16, 28.6%-1 7-32 in.; Salsbury, 32.5%-1 1-8 in.; Ewing Express, 29.6%-1 3-16 in.; Polk, 29.1%-1 3-16 inches.

Washington County Tests: Four tests were conducted by Dr. H. B. Brown, in Washington County. Results of these tests are given in table 8. These results should be worth much to planters in these immediate vicinities.

TABLE VIII. Cooperative Tests—Washington County
By Dr. H. B. Brown

Variety	Total per A. Value Dollars	Lbs. Lint per Acre	Per Cent Lint	Length of Lint Inches	Total per A. Value Dollars	Lbs. Lint per Acre	Per Cent Lint	Length of Lint Inches
	At Stoneville on Loam Soil				At Trail Lake on Buckshot Soil			
Acala 5	127.85	499	35.9	1 1-16				
Lone Star 65	144.44	503	32.0	1 1-8				
Salsbury	125.71	472	32.5	1 1-16f				
Express 432	131.98	462	32.9	1 1-8	140.9	465	31.9	1 1-8f
McLendon Express	128.70	449	32.3	1 1-8f				
Express 782	128.73	425	31.6	1 1-8f				
Walcott Express	135.33	441	29.5	1 1-8f				
Original Express	102.62	379	30.0	1 1-16				
Express 822	142.59	468	30.6	1 1-8f	135.86	422	27.3	1 3-16
Express 350	121.58	395	29.0	1 1-8f	117.95	380	27.8	1 1-8f
Lightning Express	122.62	386	29.1	1 3-16	128.18	401	28.2	1 3-16
Express 630	141.92	448	29.5	1 3-16				
Sunpress 61	144.75	394	27.0	1 1-4	136.42	373	27.3	1 1-4
Delfos 120	129.10	445	30.4	1 1-8	104.84	333	29.1	1 1-8f
Delfos 6102	169.19	562	32.7	1 1-8f	150.28	497	31.9	1 1-8f
Delfos 698	144.77	478	31.6	1 1-8f	133.45	443	32.6	1 1-8f
Delfos 631	169.39	541	31.5	1 3-16	133.93	427	31.2	1 3-16
Deltatype Webber 1	120.11	381	30.3	1 3-16	125.76	348	29.7	1 1-4
Deltatype Webber 2	136.55	435	31.0	1 3-16	134.04	362	30.3	1 1-4f
Miss. Station Trice					135.50	502	30.5	1 1-16f
Webber 49-4	128.27	404	29.2	1 3-16				
	At Dunleith on Loam Soil				At Heathman on Loam Soil			
Delfos 120	131.60	436	32.2	1 1-8f				
Delfos 6102	157.36	526	33.9	1 1-8f	113.66	403	35.3	1 1-8
Delfos 698	157.11	526	33.8	1 3-16	107.96	382	34.9	1 1-8
Delfos 631	138.14	444	32.3	1 3-16	111.46	373	34.1	1 1-8f
Sunpress 61	168.19	459	27.4	1 1-4	115.89	319	28.8	1 1-4
Deltatype Webber 1	115.27	350	30.8	1 3-16f	85.32	271	30.5	1 3-16
Deltatype Webber 2	127.40	387	30.9	1 3-16f	97.01	295	31.1	1 3-16f
Express 350	140.82	447	30.4	1 3-16	102.53	355	31.1	1 1-8f
Lightning Express	147.46	468	30.4	1 3-16	107.66	355	31.3	1 1-8f
Express 432	146.51	515	33.7	1 1-8				
Express 782	131.67	463	35.7	1 1-8				
Cleveland 54	130.08	565	36.7	7-8	87.32	385	39.7	7-8
Miss. Station Trice	110.12	484	32.1	1	84.91	358	35.2	1

NITROGENOUS FERTILIZERS

The fertilizer work was begun in 1921 and results of that year published on pages 1 to 6 in Bulletin 207. The soil is typical Deer Creek Loam which had been brought to a rather high state of cultivation and fertility by the use of legumes before the tests were begun. Cotton in 1922 followed corn. The corn in 1921 had identical fertilizer treatment, plot for plot, as the cotton in 1922. These same plots are to be fertilized in the same way each year for at least five years.

Results of the work in 1921 and 1922 are given in table 9. Three plots were averaged in each case. Express 782 has been used in all plots both years. Boll weevil infestation was very heavy in 1922. All plots were poisoned with calcium arsenate one time but the loss due to weevil was very heavy and the yields low.

TABLE IX. Nitrogenous Fertilizers

Source of Nitrogen Rate per Acre Time of Applying	Pounds Seed Cotton per Acre					Per Cent Increase	
	1922			Average 1921-22			
	Actual Yield	Corrected Yield	Increase	Corrected Yield	Increase	1922	Av. 1921 1922
Sources of Nitrogen—15 Lbs. of Nitrogen per Acre							
Check—No Fertilizer	803.3	749.2		1104.1			
Nitrate of Soda 100 Lbs.	857.7	807.9	58.7	1269.5	165.4	78.4	15.0
Ammonium Nitrate 59 Lbs.	842.3	801.6	52.4	1248.3	144.2	7.0	13.1
Ammonium Sulphate 75 Lbs.	906.6	871.6	122.4	1305.8	201.7	16.3	18.3
Check—No Fertilizer	771.1	749.2		1104.1			
Calcium Cyanamid 100 Lbs.	768.8	771.4	22.2	1126.1	222.1	3.0	2.0
Cotton Seed Meal 250 Lbs.	866.6	899.1	149.9	1266.6	162.5	20.0	14.7
C. S. Meal 125 Lbs. N. of S. 50 Lbs.	855.5	918.7	169.5	1272.9	168.8	23.6	15.3
Check—No Fertilizer	673.3	749.2		1104.1			
Rate of Applying Nitrate of Soda							
Check—No Fertilizer	752.2	732.9		1058.4			
50 Lbs.	842.2	833.7	100.8	1147.3	88.9	13.8	8.4
100 Lbs.	896.6	901.7	168.8	1231.8	173.4	23.0	16.4
150 Lbs.	946.6	967.4	234.5	1334.7	276.3	32.0	26.1
Check—No Fertilizer	705.5	732.9		1058.4			
200 Lbs.	947.7	972.2	239.3	1347.6	289.2	32.7	27.3
250 Lbs.	994.4	1007.6	274.7	1405.3	346.9	37.5	32.8
300 Lbs.	1082.2	1083.2	350.3	1394.1	335.7	47.8	31.7
Check—No Fertilizer	741.1	732.9		1058.4			
Time of Applying Nitrate of Soda—100 Lbs. per Acre							
Check—No Fertilizer	611.1	625.1		1018.5			
At Planting Time	674.4	690.8	65.7	1132.4	113.9	10.5	11.2
First Dirting	693.3	711.1	86.0	1163.5	155.0	13.3	15.2
First Squares	733.3	753.3	128.2	1191.1	172.6	20.5	16.9
Check—No Fertilizer	607.7	625.1		1018.5			
First Blooms	688.8	694.5	69.4	1197.2	178.7	11.1	17.5
½ Planting ½ First Squares	704.4	696.5	71.4	1215.2	196.7	11.4	19.3
½ Planting ½ First Blooms	691.1	670.5	45.4	1116.7	98.2	7.2	9.6
Check—No Fertilizer	656.6	625.1		1018.5			

Corrections have been made in each test for variation in soil based on check plots as follows: From the 3 check plots in each test the unfertilized yield was computed for each fertilized plot. The actual yield of each fertilized plot was multiplied by the average yield of all checks in the test. This product was divided by the assumed or computed unfertilized yield of the plot under consideration. For full details of this method see U. S. Department Bulletin No. 33.

Sources of Nitrogen: In planning this test in the spring of 1921 all materials which bade fair to offer commercial nitrogen for fertilizer purposes were considered. Since that time Calcium Nitrate or Lime Nitrogen is being offered Delta planters in commercial quantities. This material will be compared with other standard commercial nitrogenous fertilizers in 1923.

Results in 1922 show an increase of 20% for cotton seed meal, 16.3% for ammonium sulphate, 7.8% for nitrate of soda, and an increase of 23.6% for the mixture of nitrate and cotton seed meal. Average results of 1921-22, which are more reliable, show that ammonium sulphate increased the yield 18.3%; nitrate of soda, 15%; cotton seed meal and nitrate, 15.3%; and cotton seed meal, 14.7%.

All materials were applied at such a rate as to add 15 pounds of nitrogen per acre. In considering these results the prevailing market price of the various materials must be considered.

Rates of Applying Nitrate of Soda: In 1922, 50 pounds of nitrate per acre increased the yield 13.8%; 100 pounds, 23%; 150 pounds, 32%; 200 pounds, 32.7%; 250 pounds, 37.5%; and 300 pounds, 47.8%.

Average results for 2 years show the following increases: 50 pounds per acre, 8.4% increase; 100 pounds, 16.4%; 150 pounds, 26.1%; 200 pounds, 27.3%; 250 pounds, 32.8%; and 300 pounds, 31.7%.

There seems to be no logical reason why the increases from 150 pounds and 200 pounds are so close together. Future experiments may or may not change this. The outstanding percentage increase from the heavy applications in 1922 was probably due primarily to increased earliness.

In considering the results fertility of soil must be considered. The area on which these tests were made will yield nearly a bale to the acre without fertilizer. On ordinary land the difference between the increase from 150 pounds of nitrate and 200 pounds would, in all probability, be very much greater.

Time of Applying Nitrate of Soda: Results in 1922 indicate that there is danger in waiting too late to apply nitrate. Planting time seems a little early. For the average planter it seems that applying the nitrate should begin as early after the cotton is chopped as is possible and that it should all be on by the time the plants begin to set squares. Data in the third section of table 9 are not entirely consistent but future results will probably compensate the inconsistencies. It is much safer to put nitrate on a little early than a little late. Had the soil on which these tests were made been very poor the earlier applications would, in all probability, have shown up to better advantage.

SPACING

Every year it becomes more evident that the very cheapest way of increasing yields on the average plantation is by obtaining and leaving a better stand. Much cotton is planted too early for best results. Poor seed beds are other reasons for bad stand. After a stand is obtained it is often chopped up and ruined in thinning.

Results of spacing work in 1922 and average results for 4 years are given in table X. The 1922 work was done on very rich soil with Webber cotton. Three series of plots were used. Two series were thinned to 1 stalk and two stalks per hill were left on the third series. The highest plot yield was made by the plot thinned to two stalks every 16 inches. The average yield of the 3 series shows that there was little variation in yield until the space between the hills reached 20 inches. The yield of the unthinned was nearly as high as that of the plot thinned to 24 inches.

TABLE X. Cotton Spacing, 1919 to 1922

Results 1922			Av. Results 1919, 1920, 1921, 1922		
Distance in Drill	Lbs. Seed Cotton per Acre		Distance in Drill	Lbs. Seed Cotton per Acre	
	Total Yield	Less Than Check		Average Yield	Average Increase
12 Inches	1011.1	Check	12 Inches		
Unthinned	942.2	71.1	Unthinned	1234.1	285.6
8 Inches	977.8	38.8	8 Inches	1266.1	317.6
16 Inches	985.6	33.8	16 Inches	1159.9	211.4
12 Inches	1022.2	Check	12 Inches	1228.6	280.1
20 Inches	1023.3	(1)38.1	20 Inches	1102.8	154.3
24 Inches	966.7	(1)19.9	24 Inches	1057.6	109.1
28 Inches	786.7	120.6	28 Inches	948.5	Basis
12 Inches	868.9	Check	12 Inches		

(1) More than 12 inch spacing.

Average results of 4 years' work indicate best results from 8 inch spacing. Twelve inch hills show next best results except the unthinned, which is not practical. Hills cannot be left 8 inches apart but this stand can be closely approximated by leaving from 2 to 4 stalks per hill every hoe-width. The average hoe-width will closely approximate 16 inches. There is little danger of leaving too many plants. Too much stand is many times safer than too little. BE SURE TO LEAVE A STAND.

DATE OF THINNING

There have been some publications broadcasted which recommend letting cotton get 8 to 12 inches high before it is thinned. There seem to be no published data, however, on which to base such recommendations.

A test was conducted in 1922 with 5 series of plots of Webber cotton. One plot in each series was thinned when the plants had 3 to 4 leaves, and the other when the plants were 8 to 12 inches high and had begun to set squares. The plots which were thinned early averaged 736 pounds of seed cotton per acre and the late thinned plots averaged 556 pounds. The difference was 180 pounds or 32.4%. At the first picking the difference in favor of early thinning was 89%. Data on 8 tests in Mississippi and Arkansas show that thinning when the plants are small—the common practice—produced 21.5% more cotton than thinning when the plants were 8 to 12 inches tall. Thin as soon as danger of frost and dying is over.

TOPPING COTTON

The question of topping is often raised. In 1922 16 plots of loam soil were set aside for a topping test. Express 782 was used. Four plots were topped 50 days after planting; 4, 60 days after planting; 4, 70 days after planting; and 4 were not topped. The untopped plots averaged 955 pounds of seed cotton per acre; those topped 50 days after planting 851.6 pounds; those topped 60 days after planting, 960.8 pounds; and those topped 10 days later 887.5 pounds. Topping reduced the yield in both 1921 and 1922.

COTTON BREEDING

Scientific cotton breeding was begun at the Delta Station by E. C. Ewing, plant breeder at the Main Station, more than 10 years ago. When he resigned in 1915 to become plant breeder and experimentalist for the Delta Pine Land Co., Scott, Miss., his successor, Dr. H. B. Brown, continued the work until the writer took it up in the spring of 1920. Both straight selection and crossing, followed by selection, have been used with good results.

From a rather small beginning the work has grown until 1921 when 530 selections made in 1920 were tested, to say nothing of the extensive testing of promising strains brought forward from previous years. Fourteen hundred fifty single row plots were devoted to testing Delta-Station-selected cottons in 1921 in addition to the field and variety tests. The work in 1922 was practically as extensive as in 1921. Many promising strains were isolated.

The first Delta-Station-bred cottons to become commercially important were selected in the fall of 1911. Delfos 120 is still rather widely grown but Express 122 was soon replaced by Express 350, a 1913 selection, which is probably the most widely grown cotton in the Delta. Below are given the descriptions of the Station-bred strains which are now commercially important or bid fair to become so.

Express 350: Dwarf, pyramidal type (almost King type), very early and prolific, fruit limbs medium to long, foliage sparse, very few base limbs, and vegetative branches; bolls small, 80 making a pound of seed cotton, medium to pointed, opening rather wide, permitting the locks to dangle rather badly—due to short peduncles or boll stems, the upright habit of the bolls, and the tendency of the burs to curl—and the cotton to blue and gray considerably due to so much surface being exposed; the lint is good quality, 1 1-8 to 1 3-16 inches under average conditions, and 1 1-4 inches under very favorable conditions. The lint per cent has averaged 29.2 in 23 tests. Express 350 has been and is a good cotton for general use. It is considerably wilt resistant and is probably the best staple variety, now commercially available, for lands showing much wilt infection. For extremely thin lands it is not quite vigorous enough and should be replaced by Express 432 or 782 or by the Webbers. Lightning Express is a descendant of 350 and is very similar to it.

Express 432: Very vigorous and rangy for Express, early and prolific, fruit limbs very long, foliage sparse and very open, very few basal and vegetative branches; bolls small, 82 making a pound, slightly less pointed than those of 350, opening wide but retaining the locks much better than 350; lint, 1 1-8 inches under average conditions, and good quality; 32% lint in 13 tests.

Express 432 is a good cotton for general planting, usually producing higher money values than 350.

Because of its vigor it is well adapted to thin lands and to buckshot soil which produces small plants.

Express 782: Vigorous plant, resembling its parent, Express 432, but slightly later than 432, fruit limbs slightly shorter, and a somewhat denser grower; bolls medium, 75 making a pound, more pointed and larger than Express 432 or 350 bolls, and retaining the locks well; lint is 1 3-16 inches under average conditions and very silky; 31.6% lint in 8 tests. Express 782 has practically the same adaption as 432 but has longer lint and lint which is finer and silkier.

Sunpress 61: A cross between Sunflower and Express. The plant is very similar to that of Express 350 except that it is a little more vigorous and leafy. The bolls are small, 79 making a pound, with the same tendency to produce low grades as has Express 350. The lint is of excellent quality, being very fine and silky and is 1 5-16 to 1 3-8 inches when grown under average conditions. The percentage of lint is low, averaging 26.4% in 11 tests. For those who want an early, prolific, extra long cotton, Sunpress has much merit.

Delfos 6102: Very dwarf, widely pyramidal, very early and prolific, leaves very small, foliage very sparse, fruit limbs very long for the size of the plant, very few basal and vegetative branches; bolls small—81 to the pound of seed cotton—opening very wide, standing very erect, burs curl very badly, and the locks dangle and weather very badly; lint, 1 3-16 inches and of good quality under average conditions; lint percentage 31.8 in 13 tests. Due to its earliness, prolificacy, open type, and dwarfness Delfos 6102 is especially adapted to new or other rich land. This does not mean, however, that it is not good for general planting. It has made good on all types of soil. Except on wilt infected soil and probably on extremely thin unfertilized soils there is probably not a higher lint producer in existence and certainly there is no better producer in the staple class. With all of its good qualities it weathers as badly as, or a little worse than, Express 350 and has small bolls.

Delfos 631: Plant type very similar to Delfos 6102 except that it is a little more vigorous grower, and has larger leaves, shorter fruit limbs, and some more vegetative branches. The bolls are larger than those of 6102, 69 making a pound of seed cotton. The peduncles or boll stems are longer, the burs curl very little, and it is much more storm resistant than 6102. The lint is good quality and is 1 3-16 to 1 1-4 in. long when grown under average conditions. In 14 tests the lint percentage has averaged 31.1. The adaptation of Delfos 631 is the same as that of 6102 except that it is better for poor land and not so good on extremely rich soil where the rotting of the bolls, due to dense shade, is an important factor. It is not quite so prolific as 6102 but if the difference in grades and picking had been considered it would have ranked as high in value in the average of all tests where the two strains have been compared—about 25 tests in all.

BULLETIN No. 216 MARCH, 1923

The Mississippi Agricultural Experiment Stations

An Historical Sketch

By

JOHN WENDELL BAILEY
Alumni Secretary
Mississippi Agricultural and Mechanical College

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. and M. College, Mississippi
J. R. RICKS, Director

STATION STAFF

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J. R. Ricks, M. Sc.——Director and Chief in Agronomy
M. H. Moore——Secretary and Financial Agent
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C. T. Ames, B. Sc.——Assistant Director, Holly Springs Branch Station
C. B. Anders, B. Sc.——Assistant Director, Raymond Branch Station
W. E. Ayres, M. Sc.——Assistant Director and Plant Breeder, Delta Branch Station.
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H. F. Wallace, B. Sc.——Assistant at Holly Springs Branch Station
I. P. Trotter, M. Sc.——Assistant at Delta Branch Station
M. E. Andrews, M. S. A.——Associate in Farm Management
H. H. Harned, M. Sc.——Associate in Bacteriology
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Miss Mary Alice Lanier——Addressograph Operator
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L. P. Peyton——Farm Foreman, Raymond Branch Station
K. C. Livingston——Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc.——Supt. Farm Management Vocational Project
R. G. Reeves, B. Sc.——Fellow in Plant Breeding
H. B. Brown, Ph. D.——Collaborator
E. C. Ewing, M. Sc.——Collaborator

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*In Co-operation, Bureau of Animal Industry, U. S. Department of Agriculture.

Mississippi Agricultural Experiment Stations

An Historical Sketch by John Wendell Bailey, Alumni Secretary

The Agricultural Experiment Station is an important division of the Mississippi Agricultural and Mechanical College. Its field of usefulness lies in advancing knowledge through systematic experimentation and investigation. The safe and efficient progress of the whole system of agriculture depends upon the experiment stations to a far greater extent than ever before. The results of the research and investigations of this department are a necessity to the college teaching departments, to the extension divisions, and to farmers generally over the state. As Mississippi has always been, is now, and always will be a state whose chief interests lie in the proper cultivation of her soil, the value of the experiment station as a research institution for discovering and verifying the practical bearings of scientific agricultural facts and principles cannot be over-estimated.

The first stirrings of thought and awakening of effort in behalf of agricultural experimentation work in the entire Southland came from members of the first faculty and board of trustees of the Mississippi A. and M. College, in 1880, several years prior to the passage of federal acts which created *bona fide* agricultural experiment stations throughout the nation. The sudden changes in the management of land and labor which were brought about by the Civil War placed the farmers of our state in such a condition that an almost wholly new system of farming was necessary. The production of beef, butter, grain, forage crops, and the other farm products began to be recognized as an important part of our agricultural industry. Of course cotton was at that time, and perhaps always will be, our most valuable single crop, but the fact still remains that it was this pioneer work in agricultural experimentation that has, to a considerable extent, remade our commonwealth.

Abstracts from the Report of the College Farm Department, under date of December 1, 1883, ①four years prior to federal appropriation for experimental work in agriculture, tell us of some of the interesting experiments under observation at the College at that time:

FARM DEPARTMENT

Mississippi Agricultural and Mechanical College Experiments

"The farm department makes no claims as an experimental station. The work of organizing and getting in shape for economical labor has absorbed the entire time and energies

①First Biennial Report of the Trustees, President and other officers of the Agricultural and Mechanical College of Mississippi; from the Organization of the College to December 1, 1883. pp. 37 and 38.

of the superintendent and his assistants. We have, however, begun a series of experiments to determine the feeding value of cotton seed and its products, the cheapest and most permanent plan for renewing the fertility of our worn-out lands, the most desirable forage crops for our climate, the grasses best suited to our soils, and the best method of securing a stand of the same.

"We have made ordinary steers gain considerably in live weight on daily rations of cotton seed cooked and hay and straw. Several② head of dry cows, and calves nearly one year old, have been kept in good condition on an average daily ration of six pounds of seed and six pounds of hay through the winter months, milch cows consuming about twenty-five per cent more. We are making experiments to determine the comparative value of cotton seed, cotton seed meal, and corn for feeding purposes. The results of these tests will be published in full in due time. We are nearly ready to commence experiments in the dairy line, to determine questions of food, temperature, manipulation of milk, etc. Special funds, outside of the regular College appropriations, are needed to carry on this work in a satisfactory manner.

Respectfully submitted,
F. A. GULLEY,
Prof. of Agriculture and Supt. of Farm,

"Dated—
Agricultural College, Miss.,
December 1, 1883."

THE CENTRAL STATION

The Mississippi Agricultural Experiment Station, as we have it today, was organized under the act of Congress ③commonly known as the "Hatch Act," ④ and was made a department of the state Agricultural College, near Starkville, in Oktibbeha County. The general objects of the station cannot be better expressed than is done in Section 2 of the Act by which it was established. The act in full is quoted herewith:

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②Fifty.

③Twenty-fourth U. S. Statutory Laws, 1887. p. 440.

④William Henry Hatch was born in Kentucky, in 1833. He later made his home in Missouri, where he practiced law and became a circuit judge. He sided with the South in the Civil War, joined the Confederate Army and rose to the rank of adjutant general. After the war he served in Congress as representative from Kentucky. He sponsored the Agricultural Experiment Station bill in the House of Representatives and, although popularly known as "the father" of the State Agricultural Experiment Stations in the United States, he was not the originator of the idea nor the draftee of the bill. He was very active in all legislative measures for the development of agriculture. He died in 1896.

ACT OF 1887 ESTABLISHING AGRICULTURAL EXPERIMENT STATIONS.⑤

(Hatch Act.)

"AN ACT to establish agricultural experiment stations in connection with the colleges established in several States under the provisions of an act approved July second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established under direction of the college or colleges or agricultural departments of colleges in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station": *Provided*, That in any State or Territory in which two such colleges have been or may be so established the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the legislature of such State or Territory shall otherwise direct.

"SEC. 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under the varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test the comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States and Territories.

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⑤The first bill to establish agricultural experiment stations in each state in connection with the Agricultural and Mechanical College was introduced into the Senate (S. 372) of the Forty-ninth Congress soon after its assembling, on December 10, 1885, by Senator James Z. George of Mississippi. Senator George succeeded in getting the bill through the Senate after working on it for over a year. Senator George was in reality "the father" of the agricultural experiment stations in the United States.

"SEC. 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner (now Secretary) of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiment; to indicate from time to time such lines of inquiry as to him shall seem most important, and, in general, to furnish such advice and assistance as will best promote the purpose of this act. It shall be the duty of each of said stations annually, on or before the first of February, to make to the governor of the State or Territory in which it is located a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said Commissioner (now Secretary) of Agriculture, and to the Secretary of the Treasury of the United States.

"SEC. 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same and as far as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster General may from time to time prescribe.

"SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of fifteen thousand dollars per annum is hereby appropriated to each State, to be specially provided for by Congress in the appropriation from year to year, and to each Territory entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in equal quarterly payments on the first day of January, April, July, and October in each year, to the Treasurer or other officer duly appointed by the governing boards of said colleges to receive the same, the first payment to be made on the first day of October, eighteen hundred and eighty-seven: *Provided, however,* That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement, or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

"SEC. 6. That whenever it shall appear to the Secretary of the Treasury from the annual statement of receipts and expenditures of any of said stations that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

"SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

"SEC. 8. That in States having colleges entitled under this section to the benefits of this act and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any State shall have established, under the provisions of said act of July second aforesaid, an agricultural department or experimental station in connection with any university, college, or institution not distinctly an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the legislature of such State may apply in whole or in part the appropriation by this act made to such separate agricultural college or school, and no legislature shall by contract, express or implied, disable itself from so doing.

"SEC. 9. That the grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories to the purposes of said grants: *Provided*, That payment of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its legislature meeting next after the passage of this act shall be made upon the assent of the governor thereof duly certified to the Secretary of the Treasury.

"SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all the States or institutions mentioned in this act, but Congress may at any time amend, suspend, or repeal any or all the provisions of this act."

"Approved March 2, 1887 (24 Stat. L., 440)."

Mississippi accepted the provisions of this act by the state legislature's adopting the following act:⑥

"Section 1. Be it enacted by the Legislature of the State of Mississippi, That the State of Mississippi hereby accepts the provisions of an act of Congress entitled an act to establish agricultural experiment stations in connection with the colleges established in the several states under the provision of 'an act approved July 2nd, eighteen hundred and sixty-two, and acts supplementary thereto, which act was approved March 2nd, 1887.'

"Section 2. That the money received by this state under the aforesaid act shall be expended under the direction of the Agricultural and Mechanical College of this State, situated near Starkville; and the agricultural experiment station for this State provided for in said act of Congress, shall be established in connection with said college, and the trustees of said college be and they are hereby authorized to set apart for the use of said station so much of the land and other property belonging to said college as they may deem neccessary from time to time.

"Section 3. Be it further enacted, That this act be in force from and after its passage.

"Approved January 31, 1888."

⑥Laws of Mississippi, 1888, Chapter 32, p. 54.

At first the general control of the station was placed in the hands of a general board of control, consisting of the trustees of the College and a governing board of three members, the president of the College, the local trustee, and the director of the station. The immediate control of the station was placed in the hands of the governing board.

Within a few months after the establishment of the station the governing board realized that the station might profit by counsel and advice on various agricultural problems from the different sections of the state. For that reason an advisory board was created. The board included the president of the State Farmers' Alliance, the master of the State Grange, the president of the State Wheel, the president of the State Horticultural Society, and the president of the State Grass Growers' Association. Early in 1890 the advisory board became inactive, and since that time has not taken any part in the work of the station. A reorganization of the board of trustees of the College in 1912 did away with the custom of having a local trustee; consequently, since that date the work of the station has been directed solely by the president of the College and the director of the Experiment Station.

The first general board of control was as follows:

Trustees

His Excellency, Robert Lowery, Ex-Officio President.
Dr. H. A. Minor---Macon
Hon. H. M. Street---Meridian
Hon. J. Z. George---Jackson
Hon. L. B. Brown---Enterprise
Dr. Geo. H. Peets---Woodville
Hon. J. R. Cameron---Canton
Col. W. B. Montgomery---Starkville
Hon. J. M. Stone---Iuka
Major T. C. Dockery---Hernando

Governing Board

Gen. S. D. Lee---President A. and M. College
Col. W. B. Montgomery---Local Trustee
S. M. Tracy---Director Experiment Station

Advisory Board

R. T. Love---President State Farmers' Alliance
J. B. Bailey---Master of State Grange
R. L. Tynes---President of State Wheel
H. E. McKay---President State Horticultural Society
W. L. Hemmingway---President State Grass Growers' Association

As no funds for expenses were received until March 15, 1888, when the season was too far advanced for much planting, no large amount of experimental work was completed the first year. However, the time of the working force was fully occupied in building, selecting and arranging equipment, clearing, fencing, and draining land, planting fruit trees, etc., and doing the necessary preliminary work which must always precede any carefully conducted experiments.

When the Experiment Station was organized, the College farm consisted of eighteen hundred acres of land, on which were found a great variety of soils, varying from rich unused bottom lands to barren hills that had been so worn out with successive cotton crops that ten years of rest had failed to make them produce even a crop of weeds. So much of this land as was needed for experimental work was placed at the disposal of the station. The station also had the use of a portion of the feeding sheds belonging to the College farm department, and arrangements were made whereby the station used such stock belonging to the College herds as were needed in making certain tests.

In return for these accommodations, the station gave the farm department a fair equivalent in the crops grown, etc., it being the aim of the trustees that the work of neither the station nor the College should be done at the expense of the other.

Use of the College creamery, which had been thoroughly remodeled and furnished with a steam boiler, a lactocrite, and other necessary apparatus, was given to the station for solving its problems in the field of dairy industry. For horticultural work the station had the use of the College vegetable gardens, orchards, vineyards, etc., and in addition erected a greenhouse, 25 x 75 feet, for the horticulturist and also for use in the chemical work and in the study of parasitic fungi.

The meteorological outfit was complete, consisting of a hygrometer, self-registering anemometer, sunshine recorder, rain gauge, maximum and minimum self-registering thermometers, and two sets of soil thermometers.

For chemical work, the station provided a well equipped laboratory of seven rooms on the ground floor of the College laboratory building. These rooms included an analytical room, a store room for supplies and for samples, and the balance room and the office. The building was furnished with gas by a gasoline machine and with an abundant supply of water under pressure. A two-horse power boiler provided distilled water for the laboratory and steam for other purposes.

For the general work of the station, a small frame building, 20 x 40 feet, was erected for office, library, and microscope room, the basement furnishing tool and storage room. A carefully selected library and an excellent microscope with the necessary accessories were purchased.

A considerable portion of the farm consisted of wet creek bottoms and "seepy hills." In order to prepare this land for experimental work over a mile of tile drain was laid, and a large number of open ditches were made to protect the experimental plots from being washed by floods from adjacent lands.

Even in the very beginning of the station's work those in charge recognized the fact that results obtained by field experiments made upon small plots are often unreliable and misleading, but they also realized that it was impossible to make any great number of trials on fields covering many acres each; consequently, it was thought best to combine the two plans, by making a considerable number of tests upon plots containing one-tenth acre each and then duplicating the more promising of the tests on larger areas. This was made possible during the early days of the College, because the Director of the Experiment Station and the Professor of Agriculture in the College would get together and agree upon certain lines of work of the station and of the work of the College, so that the farm work of the College was to a great extent a duplication on a large scale of the most successful work done by the station. This arrangement brought the practical work of both departments in close relation, each helping to strengthen and emphasize the other.

The Experiment Station staff has always been more or less intimately connected with the faculty of the School of Agriculture. Of the eleven members of the first station force seven were on the College teaching staff. However, in recent years the station force has become more distinct from the teaching staff of the College, and today of the forty-four members of the station force only fourteen are members of the College teaching staff, and they devote only a small amount of time to the station work.

The personnel of the first station force was as follows:

S. M. Tracy, M. Sc._____Director
*B. Irby, M. Sc._____Agriculturist
E. R. Lloyd, M. Sc._____Assistant Agriculturist
*A. B. McKay, B. Sc._____Horticulturist
*B. W. Saffold, B. Sc._____Assistant Horticulturist
*D. L. Phares, M. D._____Veterinarian
*W. L. Hutchinson, B. Sc.__Chemist
B. von Herff, Ph. D._____Assistant Chemist
L. G. Patterson_____Assistant Chemist
*B. W. Kilgore, B. Sc._____Meteorologist
*T. F. Watson_____Treasurer

One of the greatest evils against which the station has had to contend is the frequent changes of the staff, due to two causes—insufficient salaries and insecurity of tenure. Only one man, Professor E.

*Members of the College Staff also.

R. Lloyd,[7] remained with the station for any long period of service. Professor Lloyd was a member of the first station staff and served for thirty years and three months. He came to the station in October, 1888, as assistant agriculturist, and held almost every position on the staff, including the directorship of the station. He resigned on December 31, 1918, to become Director of the Farm Development Bureau of the Memphis, Tennessee, Chamber of Commerce. Many of the station workers have remained less than a year; others, one, two, three, and four years. As a matter of fact, the working force was almost wholly changed between its organization in February, 1888, and December of the same year. The agriculturist, Professor F. A. Gulley, resigned on February 21, 1888, to accept the directorship of the Texas Station; the chemist, Professor John A. Meyers, answered the call to take charge of the West Virginia Station; Professor J. H. Connell was elected professor of Agriculture in the Kentucky Agricultural College; Mr. Harrington accepted the professorship of Chemistry at Texas A. and M. College; and two assistants were called to similar positions at other stations. All of these men resigned before the actual work of the station was started; consequently, they were not given on the list of the first station force.

As experiments frequently must extend over a series of years before any satisfactory results can be obtained, these sweeping changes, of course, interrupted the work and in some instances caused serious losses. When new men have been secured, it has been a hard matter to get them to take up where their predecessors left off. Each man has his own methods and wishes to continue experiments begun elsewhere.

All the experiments of this station have been with crops or animals which were already known in this state, or with those whose introduction might prove beneficial to our citizens. With the opening of the station in 1888 work was begun on soil tests, fertilizers, cotton, corn. forage crops, fruits, vegetables, sugar cane, insect control, veterinary problems, cattle feeding and breeding, soils, and the problems of cultivating drained and undrained lands. The following year a botanical survey of the state was started. Bulletin Number 20 presents partial results of the survey. In 1890 experiments with wheat, flax, castor beans, raspberries, blackberries, and strawberries were begun. Series of experiments on the chemistry of various plants as well as soils, feeds, etc., have been carried on from time to time.

Realizing the importance and desirability of first-hand knowledge

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[7] Edward Ried Lloyd, son of Rev. and Mrs. W. E. Lloyd, was born March 10, 1867, at Auburn, Alabama. He received the degree of Bachelor of Science in Agriculture from the Alabama Agricultural and Mechanical College (now the Alabama Polytechnic Institute) in June, 1887. The following year, 1888, he received the M. Sc. degree. He came to the Mississippi Agricultural Experiment Station, October 22, 1888, as assistant agriculturist. He is now Director of the Bureau of Farm Development of Memphis Chamber of Commerce, Memphis, Tennessee. ,

concerning the agricultural possibilities of the various sections of the state, the directors of the Experiment Station decided to ask for the co-operation of representative agricultural societies throughout the state. In addition to the agricultural societies a few individual farmers were asked to lend their assistance. The result was the inauguration, in the spring of 1890, of three small experimental plots located at Lake, Holly Springs, and Ocean Springs, under the supervision of Dr. J. B. Bailey, Honorable F. J. Fairley, and F. S. Earle, respectively. Although known as branch experiment stations, these plots consisted of only a few acres, and were merely loaned, so to speak, to the community for various tests carried on, by the man in charge, under directions from the College Experiment Station. The fertilizers, seed, trees, and the like were furnished by the Experiment Station. The man upon whose land the experiments were conducted was the chief beneficiary, but the farmers in the community shared with him the knowledge gained through the experiments. At Lake and Holly Springs experiments with numerous fertilizers, cotton, and grasses were conducted; at Ocean Springs semi-tropical fruits, vegetables, rice, and sugar cane were experimented with on a fairly large scale. A series of experiments with fruit trees was begun in 1892 at Booneville, under the personal supervision of Dr. D. G. Price. The Experiment Station reports show that these branch stations did not continue their experimental work after the year 1895.

The original "Hatch Act" promised $15,000 per annum for the support of the Central Experiment Station. Additional funds were made available through the passage of the Adams Act, approved March 16, 1906. The section of the Act bearing directly upon the Agricultural Experiment Station is as follows:

THE ADAMS ACT

"Section 1. Be it enacted by the Senate and the House of Representatives of the United States of America in Congress assembled, That there shall be, and hereby is, annually appropriated, out of any money in the Treasury not otherwise appropriated, to be paid as hereinafter provided, to each State and Territory, for the more complete endowment and maintenance of agricultural experiment stations now established or which may hereafter be established in accordance with the act of Congress approved March second, eighteen hundred and eighty-seven, the sum of five thousand dollars in addition to the sum named in said act for the year ending June thirtieth, nineteen hundred and six, and an annual increase of the amount of such appropriation thereafter for five years by an additional sum of two thousand dollars over the preceding year, and the annual amount to be paid thereafter to each State or Territory shall be thirty thousand dollars, to be applied only in paying the necessary expenses of conducting original researches or experiments bearing directly on the agricultural industry of the United States, having due regard

to the varying conditions and needs of the respective States or Territories.

"Approved March 16, 1906."

For several years previous to the passage of the foregoing act farmers throughout the entire land were constantly demanding larger and more efficient farm implements. Any increase in the size and efficiency in farm implements necessarily called for a corresponding increase in weight and efficiency in team power. The latter was entirely lacking in all of the Southern States because the Southern farmers were unknowingly breeding small, inferior jacks to unsound and immature mares. Then too the colts had always been underfed and improperly cared for during the first year.

The funds made available through the Adams Act made it possible to increase the facilities and equipment of the central station, and to inaugurate a group of mule breeding experiments that finally refuted the old idea that the heavy high-priced mules could not be raised in the South. These mule breeding experiments were begun in 1906 and covered a period of about fifteen years. They have attracted more attention than any other experiments of an agricultural nature that have been conducted in the entire South.

Other experiments begun in 1906 with funds from the Adams Act were with cattle, horses, and poultry, injurious insects, and plant diseases.

Of all the experiments (with the possible exception of the mule breeding experiment) carried on by the Agricultural Experiment Station of Mississippi those on cotton breeding are perhaps the most important. In these cotton experiments considerable work has been done in the way of breeding improved varieties to produce better wilt-resistant, better yielding early short staple, and better long staple varieties. This work is carried on by means of plant selection and progeny row testing, by hybridizing varieties, and by acclimatizing imported varieties. Some very encouraging results have been obtained in this work. Foster-120-6102, a very early and very prolific strain with a staple of about 1 3-16 inches in length, has recently produced a bale and a half per acre at the Delta Station at Stoneville.

Acclimatization work is carried on with the North Carolina and Texas Agricultural Experiment Stations, and shows that Mississippi grown seed produce a better yield than the imported seed.

Work at the central station, as well as at the branch stations, has been thoroughly systematized. Every piece of experimental work at any of the stations must be carefully planned and an outline of the project submitted to the central office. This outline, in turn, is referred to a committee on projects for criticism before final approval and before work can actually begin. This has been found necessary because too often some one would begin work on some problem with-

out giving sufficient thought to formulate a project of value, and then after money had been spent the work would be dropped and no results reported. And too, when a member of the staff leaves the service, his successor often times wants to undertake a new line of projects and drop some that are not finished even though considerable money has been expended on them. By requiring approved projects and by requiring that these projects be kept active for a sufficient time to draw definite conclusions, dependable results with the least expenditure of money are secured.

The funds of the central station come from both the Federal and state governments. From the Hatch and Adams Acts a total of $30,000 annually is received from the Federal government. At the 1920 session of the state legislature an appropriation of $27,300 for 1920 and $19,300 for 1921 was made. This is the first state money ever appropriated for the central station and was for new work, that is, for work which could not be done because of inadequacy of the funds received from the Federal government. The branch stations are supported entirely from state appropriations. During the last few years these stations have done better work than ever before because the funds made available by the legislature were sufficient properly to equip them and to meet the expenses of doing the work. From the time these stations were established until the beginning of the biennial period 1919-21, appropriations received were not sufficient for the best work. A brief outline of the work which has been done and which is being done by the central station is as follows:

Agronomy

The Department of Agronomy has under way at the present time the following projects: Effects of certain crops on soil fertility, forage crops, the use of various forms of lime for different crops, permanent pastures, temporary pastures, cultural methods of corn, various forms of nitrogen for corn and cotton, sulphur fertilizers for alfalfa, phosphate investigations, crop rotations, different crops for silage, cotton wilt test, corn and cotton spacing, variety test with corn, cotton and other common field crops, and co-operative fertilizer tests.

Valuable data have been obtained on these lines of investigations. Bulletins and circulars have been published, giving results from the work with corn and cotton.

The funds used for all projects in the Department of Agronomy are the Hatch and Federal Sales Funds. No state funds are available for the work. There are many new projects that should be undertaken in this department. The work at the central station and at the branch stations with fertilizers is not enough to give the information needed for all soil types in the state. Additional funds to carry on co-operative fertilizer and crop work in many counties where results from the stations will not apply are needed.

Animal Husbandry

Experimental work in this department is carried on with four classes of farm animals: horses, beef cattle, sheep, and hogs.

Horses—The work in mule breeding is now completed, and in the near future the results will be published. This is an Adams Fund project and has been referred to on preceding pages. It has been the most expensive project ever undertaken, and has required large numbers of animals and a long time for results.

Beef Cattle—For this work small pure-bred herds, each of one of the three varieties—Hereford, Angus, and Shorthorn—are used. In addition to these a fair sized herd of grade cows of each of three breeds is maintained for breeding purposes. The work consists in grading up by the use of pure-bred bulls on the various grades and comparing offspring from each; the feeding of steers to compare the different feeds; and the cost of wintering and handling the breeding herds. Enough data have been obtained on the feeding of steers for a good bulletin, which will be published in the near future. Also, some valuable data on the cost of wintering and the handling of the breeding herds have been obtained.

Sheep—For the past two years there has been some work done in grading up native sheep by the use of pure-bred rams. On account of the limited pasture space it is impossible to do this work on a large enough scale to get the best results. However, some valuable data have been obtained and tabulated.

Hogs—This work includes grazing tests with different crops, different feeds, and methods of feeding, and soft pork investigations. Three years' results on these different projects, which are valuable, especially on soft pork, are available.

Bacteriology

This work is done as an Adams Fund project. Some of the more important projects are: the comparing of different green manure crops with forest leaves, the limit of the amount of green manure crops to be used for profitable returns, accumulative effects of compost materials compared with alfalfa, and pounds of nitrogen contained in different crops from soils of different degrees of fertility. These are all long, technical projects, and will require several years for completion.

Zoology and Entomology

The work of this department consists of the following projects:

I. A systematic and biological study of the crayfish of Mississippi.

II. A systematic and biological study of the insects affecting pecans.

III. A systematic and biological study of the scale insects of Mississippi.

IV. Boll weevil control work:
  (a) Poisoning tests with calcium arsenate.
  (b) Parasites of the boll weevil.

V. Studies of the nematode parasite of young calves.

VI. Studies of the hookworm infestation in new students at the College.

VII. Beneficial parasites of the Southern grass worm.

In connection with the studies of the hookworm infestation in new students some interesting points were brought out. It appeared that the distribution of new students was quite uniform over the state, but the hookworm infestation was largely confined to residents of a group of about fifteen counties lying in the east-central part of the state. The average infestation for student residents of Mississippi was about one to ten, while for the group of counties mentioned above it was approximately one to every four.

Dairy

The work in this department has been expanded since the 1920 session of the legislature. A small appropriation made this work possible. Some excellent results have been obtained from: early vs. late fall calving; spring vs. fall calving; methods of calf raising; value of cottonseed hulls as compared with Johnson grass hay; value of blackstrap molasses for feed; cost of raising calves and of hay or pastures for young calves. In addition to these projects, there are other important lines on which some work has been started.

Plant Pathology

This work is in the Department of Botany and Forestry. The work was started a little more than a year ago, but good progress has been made. Some good data have been obtained on tomato diseases, diseases of the sweet potato, pecan scab, and corn root rot. In addition to these projects, a survey is being made of the plant diseases of the state. This work is done in co-operation with the U. S. Department of Agriculture and the Mississippi Plant Board.

Horticulture

Experimental work in Horticulture has been neglected at this station for more than ten years, because there have been no funds available for this project. A small appropriation was made by the 1920 legislature, which enable the station to employ a horticulturist half

time, the other half time being devoted to teaching. The work is important enough to have one or more all-time men. Considerable progress has been made with the various projects, which include apples, peaches, grapes, Japanese persimmons, figs, strawberries, and sweet potatoes. Several years will be required for results from these projects, as the orchards were, for the most part, started anew in 1920.

Poultry

The professor of Poultry in the College is in charge of this work and devotes one-half of his time to it. The work consists of a feed test with the different breeds of chickens, each breed getting the same feed to determine their economic value as egg producers.

Another experiment with poultry is a comparison of some of the important protein feeds as to their relative value as egg producers. The three feeds that were used were cottonseed meal, beef scraps, and skimmed milk.

Farm Management

The work in this department is in charge of the professor of Agricultural Economics. Some valuable results have been obtained on the different projects under way, which include farm surveys in Jones and Copiah counties, a survey of one hundred or more farms in Bolivar county, the survey of an area in northern brown loam soil, and a Boys' Farm Management Club. The last named project is one in which boys are interested in keeping farm records and is one by which the department is accumulating very valuable data at a small cost. The work of this department is exceedingly important, and it is hoped that the station may be able to push the operations, as information on various lines is badly needed.

Farm Tractor and Machinery

Realizing the very great need of information on the various tractors and other farm machinery on the market, the central station began in 1920 in a small way to do as much testing of these as the funds would permit. The agricultural engineer did some valuable work in comparing several different makes of tractors as to their durability, their adaptability to the stiff soils of the station farm, and the expense or cost per acre for each. In addition good results were obtained with power cultivators, different hay machinery, and methods of saving hay.

On account of there being so much machinery on the market for sale that often will not work, it is thought that this work should continue and on a much larger scale. Many inquiries are received as to which is the best tractor, the best cultivator, or the best of many other types of farm machinery. The station should be able to give this

information. In all sections of the state one can find tractors and other farm machinery that have been junked because they were worthless. No doubt many thousands of dollars are spent annually by farmers for machinery that is practically useless.

Publications

In compliance with Section Four of the original Hatch Act, the station early began the issuance of bulletins, circulars, and reports. These papers are treatises on the various phases of agricultural investigations conducted by the Experiment Station staff. About four hundred such papers have been issued, a complete list of which will be found on page 43 of this publication under the heading "Publications of the Mississippi Agricultural Experiment Station".⑧

THE SOUTH MISSISSIPPI BRANCH AGRICULTURAL EXPERIMENT STATIONS

Coastal Plains Branch Station and South Mississippi Branch Station

The South Mississippi Experiment Station, which was formerly the McNeill Branch Agricultural Experiment Station, is the result of legislation by the state legislature of 1900, at which time that body passed an act to provide for the establishment of a permanent branch agricultural station in South Mississippi. The act is as follows:

> An Act to provide for the establishment of a permanent branch agricultural experiment station.⑨
>
> "Section 1. Be it enacted by the Legislature of the State of Mississippi, That the Board of Trustees of the Mississippi Agricultural and Mechanical College, located at or near Starkville, are hereby authorized to establish a branch agricultural station at some point in the state south of the tier of counties on the line of the Alabama and Vicksburg Railroad and in what is known as the piney woods region of the state. The said board of trustees are authorized to accept donations of lands, lumber, agricultural implements, fertilizers, money, notes or other obligations or any property or thing that may be of use in establishing and operating said experiment station.
>
> "Section 2. The station herein provided for shall be on a tract of land not less than two hundred acres, and shall only be located where suitable land is donated and conveyed to the trustees for that purpose, and if land in excess of two hundred acres are donated, the said board of trustees may, in their discretion, sell the same and apply the proceeds to the improvement of the land retained and used for said experiment station.

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⑧Published originally in "The Mississippi A. and M. Alumnus", the official publication of the Alumni Association of the Mississippi Agricultural and Mechanical College, under date of June, 1922.

⑨Laws of Mississippi 1900, Chapter 61, pp. 69 and 70.

"Section 3. In locating said station the said trustees shall consider the natural advantages, the health and convenience to a shipping point, and the amount proposed to be donated by any locality or localities, and all other matters that may be of material advantage in the working of the same.

"Section 4. That this act shall be in force from and after the date of its passage.

"Approved March 12, 1900."

After considering the proposals for locating a branch agricultural experiment station in the southern part of the state as authorized by the above act, the committee from the board of trustees decided that the offer made in behalf of McNeil, in Pearl River county, was the most advantageous, and located the station at that point. The land donated amounted to nearly 2,000 acres, not all in a body, but much more than was required. It fronted on the New Orleans and Northeastern Railroad for a distance of half a mile, beginning immediately south of the station. For development and profitable returns the piney woods region offered abundant opportunities. Lumber and turpentine constituted nearly the whole of marketable products and had made the country prosperous. The people of the vicinity realized, however, that such prosperity was limited, and that destruction of the timber should be followed as rapidly as possible by tilling of the soil. For that reason they desired to have the agricultural experiment station located in their community, and made their contributions very liberal. In addition to nearly 2,000 acres of land, the people of Pearl River and Hancock counties and the New Orleans and Northeastern Railroad Company donated $3,937.55 in cash, contingent upon an early location and commencement of work. As the legislature had authorized the organization of this branch station and failed to provide funds for the buildings and equipment, the trustees authorized the special committee in charge to incur such indebtedness as was necessary in placing the station on an operating basis. This indebtedness was incurred, and, as soon as building began, lands immediately around McNeil advanced in price. The sale of the surplus lands donated would have more than paid the indebtedness of the station, but it was thought bad policy to sell them before they reached their highest value.

The legislature of 1902 made the first actual cash appropriation for this station. Ten thousand five hundred dollars was made available to meet the expenses of the station and provide suitable equipment. Mr. E. B. Ferris, a graduate of the College, Class 1895, was placed in charge.

In the early history of the station at McNeil, a great deal of work was done with fruits and vegetables, the kind and varieties best suited to the section, how best to fertilize them, together with the growing of a number of these crops in quantities sufficient to determine their value from a monetary standpoint. After several years of work of

this kind and after the sales fund was taken from the station, they were forced to abandon much of this kind of work on account of a lack of funds and the seeming greater importance of other lines of work at that time. That section, however, seems destined to become at some time one of the main trucking sections of the country, having soils naturally suited to such crops and being served by one of the best railroad systems of the entire country, with access to all of the important cities of the North.

The legislature of 1918 provided for the removal of this station to Poplarville, about twelve miles from the old site. The Act[10] authorizing the change is as follows:

> "An Act to authorize the board of supervisors of Pearl River county to donate and convey in fee simple to the Board of Trustees of the Mississippi A. and M. College a certain tract of land to be used as a branch experiment station; to authorize said Board of Trustees to receive said property and to remove the McNeil Branch Experiment Station from McNeil, Mississippi, and to locate the same on the land purchased near the town of Poplarville, to authorize said Board of Trustees to sell all but five hundred acres of the land now belonging to the McNeil Branch Experiment Station and to carry on pasture experiments in connection with the Southern Pine Association on the five hundred acres retained.
>
> "Section 1. Be it enacted by the Legislature of the State of Mississippi, That the board of supervisors of Pearl River county be, and the same is hereby authorized to donate and convey in fee simple to the Board of Trustees of the Mississippi A. and M. College a certain tract of land lying near the town of Poplarville, Mississippi, formerly used as a county convict farm, and now owned by Pearl River county, the same to be used as a new location for the McNeil Branch Experiment Station; said trustees are authorized to receive the land mentioned above to be used for the purpose indicated.
>
> "Section 2. That the Board of Trustees of the Mississippi A. and M. College be and are hereby authorized to remove the McNeil Experiment Station, together with such buildings and equipment as may be necessary to the land acquired by the purchase mentioned in Section 1 of this Act, near the town of Poplarville, and to operate the McNeil Branch Experiment Station on the new property instead of at McNeil as at present.
>
> "Section 3. That the said trustees are hereby authorized to sell and convey in fee simple any part or all of the land now belonging to the McNeil Branch Experiment Station, except five hundred acres to be retained for the purposes hereinafter stated. The said trustees are also authorized to conduct in connection with the Southern Pine Association pasture and other experiments on the five hundred acres retained at McNeil, Mississippi, in accordance with plans to be worked out

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[10] Laws of Mississippi, 1918, Chapter 419, p. 416.

by the directors of the experiment stations and approved by the Southern Pine Association.

"Section 4. That this act take effect and be in force from and after its passage.

"Approved March 29, 1918."

The old station site at McNeil is now conducted jointly by the central station and the Bureau of Animal Industry of the U. S. Department of Agriculture, with S. W. Greene in charge. The work is principally along livestock lines, such as, feeding steers, utilizing native grown feeds; grading up, by the use of pure-bred bulls, the native cows of that section; and making permanent pastures. Also, some work is being done with animal parasites, sheep, and hogs, and the testing of many varieties of forage crops. The Bureau of Plant Industry of the U. S. Department of Agriculture has recently furnished an agronomist for the forage crops work there.

As more appropriate to the territory which it serves, the name of the station has been changed to South Mississippi Experiment Station, while the work being carried on at McNeil is under the name of Coastal Plains Experiment Station.

While the station at Poplarville has no official connection with the one at McNeil, the two institutions have worked in perfect harmony and have been very helpful to each other in the exchange of labor, machinery, and plans of work. On account of the connection of the station at McNeil with the Department at Washington, the Poplarville station is visited by many of the experts from the Washington Office, who have offered many valuable suggestions and have furnished seeds for many promising crops. In 1920 an assortment of vetches and bur clovers was given this station, and among them were found several that give promise of greatly improving winter pastures. In the new location the connection with the local Agricultural High School is very close and altogether pleasant and profitable. The students from this school do a lot of the work on the station farm and keep constantly in touch with all experiments in progress by frequent visits with their instructors, who explain to them the nature of the work and find it a great help in teaching agriculture and horticulture.

During the last few years a great many improvements have been made on the property at Poplarville. These include the completion of a twenty-cow dairy barn; addition to and slight changes in the mule barn; a complete rearrangement of fields and the building of several miles of inside fences, so as to divide the land into a number of fields separately fenced, all of which have been set aside for specific experimental work. A little more than $4,000 was spent on a cottage for the local director, and as this building is situated within the corporate limits of the town of Poplarville, adjoining the Agricultural High School and at the intersection of two important highways, a good deal of effort has been put forth to make the place attractive by beautifying the grounds and providing attractive shrubs and flowers. A neat of-

fice has been built close to this cottage, which gives space for several desks and a special room for filing the numerous bulletins which are received there. The old paupers' home has been divided into two parts, and these moved so as to front the highway and converted into two five-room cottages for laborers. The cottage formerly used as a home for the keeper of the poor-house has been enlarged and improved as a home for the station foremen. A sweet potato drying house was built in 1920, and complete records are kept during the winter on the curing of this important crop. A cottage for the assistant director has recently been erected. One new cottage for laborers has been built, all buildings new and old have been painted, yards and gardens provided, and shade trees set out. These buildings complete the present needs of the station.

In recent years the people of South Mississippi have manifested considerable interest in trucking; and since the removal of the station to Poplarville and the increased support from recent legislatures, it was decided to resume this character of work. In 1920 the station engaged the services of a graduate of one of our leading universities, a man of wide horticultural experience, who at that time was employed as Extension Horticulturist for the State of Mississippi. He started some very important horticultural investigations, which are reported below.

"1. Variety tests of fruits and vegetables and foreign introductions.

A. Fruits—Variety tests of peaches, plums, grapes (including grafted Vinifera grapes), figs, dewberries, blackberries, raspberries, blueberries, pears, Japanese persimmons, pecans, English walnuts, and citrus fruits.

B. Vegetables—Sweet potatoes, cantaloupes, watermelons, tomatoes, beans, cauliflower, and cabbage.

C. Foreign Plant Introduction—Salvia hispanica, Parthenium, Ciner caefolium, Solanum tuberosum, Solanum bullatum, and Allium cepa.

"2. Plant Selections:

On Irish potatoes, sweet potatoes, sweet corn, and tomatoes, said selections being carried on with a view of increasing productivity, marketable qualities, and disease resistance. The work on tomatoes is concerned especially with selecting wilt-resistant strains; four varieties that are apparently wilt-resistant are now being tested in soil inoculated with wilt fungus.

"3. Fertilizer Investigations:

This work is being done with tomatoes, potatoes, and strawberries. Sod and clean culture plats are being used in figs, peaches, pecans, and satsuma oranges.

"4. Cultural Practices:

Records are being maintained on pruning work, spraying for control of insects and diseases, cultivation and use of cover crops on orchard and truck plats."

Thirteen acres of land, selected as being the best here for the purpose, have been set aside for this work with fruits and vegetables, and practically all the work, as outlined above, has been started. Apparently the work done years ago with truck crops at McNeil is having its effect now in the interest being manifested by individual farmers in market gardening. As a result of the work begun by the station at McNeil, the people of this small village have gradually increased their acreage until now they ship beans, cabbage, squash, Irish potatoes, and sweet potatoes in car lots, and are, perhaps, the largest shippers of such products in South Mississippi, off the Illinois Central Railroad. This interest has recently extended to peaches. About one hundred acres of peach trees were set out at McNeil last winter, through the efforts of the fruit and vegetable agent of the Southern Railway, and the people there are now organizing to plant a similar acreage to strawberries. This interest has extended to other nearby points on the Southern Railway. Large plantings of peach trees have been made at Poplarville and Hattiesburg, and trucking has been started at Poplarville and Purvis.

In order to be effective, fertilizer work has to extend over a series of years and be conducted on land of known history. In order to obtain reliable results from a large number of experiments with fertilizers, planned by the station force with the assistance of one of the leading fertilizer experts of the country, about ten acres of the levelest land which has been divided into some one hundred small plats has been permanently set aside. These have been fertilized the same way for the past three years, and will continue to be so fertilized for a number of years to come, with the hope of being able finally to get positive and definite information as to the needs of these soils for the different elements of plant food, with and without the application of lime, the use of restorative crops, and the practice of rotation.

Work is being conducted both at McNeil and at Poplarville on the development of permanent pastures. At Poplarville twenty-six acres of land have been set aside for the work. This land has been divided into two equal parts; on one part oats and lespedeza are grown, and on the other carpet grass is planted in several different ways. Seeds are being saved from the most promising kinds of winter legumes, notably the bur clovers, and these will be sown over both pastures with the hope of furnishing better grazing for winter and early spring. These pastures are being used for cattle and hogs. In 1920 the pasture from oats and lespedeza proved highly successful, the seasons having been unusually favorable. It remains to be seen what the same crops will do when the summer is dry and the lespedeza is liable to be killed by lack of moisture.

Adjoining the permanent pastures is a ten-acre field devoted to the growing of field crops for hogs. Here valuable data are expected as to the cost of pork production, with the use of lespedeza and oats for

permanent pasture and such crops as peanuts, soy beans, chufas, and cow-peas as additional summer feed crops.

At McNeil there were kept a number of dairy cows, an average of twenty being milked. The most of these were grade Jerseys. At Poplarville, there was not room for so many cattle, and all save the registered Jerseys were sold. These registered animals, ten cows and several calves, were carried to Poplarville. Shortly after moving them to Poplarville the station was milking ten cows and had expected to start experimental work with them, but hemorrhagic septicemia appeared suddenly in the herd and four of the best cows died in a day. This did not leave a sufficient number with which to do experimental work; so the herd has been held together awaiting the time when a sufficient number of heifers would grow into cows. The milk from this herd has more than paid the expense of keeping them and the calves were a profit. In 1920 a very fine Jersey bull was leased from a cattle dealer in Georgia for use as a herd bull. The animal has 75% of the blood of the noted Jersey bull for which the Sharples Separator Company paid $60,000, and already the station has several heifer calves from him, and other cows about ready to freshen.

In collaboration with the plant breeder of the central station and the three other branch stations of the state, this station is carrying on work improving strains of cotton and corn and the testing of varieties of these two crops.

For a number of years annual excursions were run to McNeil, to bring in people interested in visiting the station, and one summer some four thousand people came on these excursions. While these excursion trains have been temporarily discontinued, plans to resume them and to use every means to popularize the work of the station with the farmers of the territory which it is supposed to serve are now under way.

A total of $219,330.69 has been expended by the South Mississippi Experiment Station since its establishment in 1900 as the old McNeil Station. The financial chart on page 36 shows the amount of these funds, and from what source they were derived.

ADDITIONAL BRANCH EXPERIMENT STATIONS

Through legislative acts in 1904, two branch agricultural experimental stations were established, one at Stoneville, Washington county, in the Yazoo-Mississippi Delta, and the other at Holly Springs, Marshall county, in North Mississippi.

The act to provide for the establishment of the Delta Station, approved February 20, 1904, is as follows:

> "AN ACT to provide for the establishment of a permanent branch agricultural experiment station in the Yazoo and Mississippi Delta, contiguous to the Delta.[11]

[11] Laws of Mississippi, 1904, S. B. No. 22, Chapter 85, p. 115.

"Section 1. Be it enacted by the Legislature of the State of Mississippi, That the board of trustees of the Mississippi Agricultural and Mechanical College, located near Starkville, are hereby authorized to establish a branch agricultural station at some point in the state in what is known as the Yazoo and Mississippi Delta, or in some county adjoining said Delta at a point where experiments with the soil of the hills as well as the Delta can be made. The said board of trustees are authorized to accept donations of lands, lumber, agricultural implements, money, notes, or other obligations, or any property that may be of use in establishing and operating said experiment station.

"Section 2. The station herein provided for shall be on a tract of land of not less than two hundred acres, and shall be located where suitable land is donated and conveyed to the trustees for that purpose, and if lands in excess of two hundred acres are donated, the said board of trustees may, in their discretion, sell the same and apply the proceeds to the improvement of the land retained and used for said experiment station.

"Section 3. In locating said station, the said trustees shall consider the natural advantages, the health and conveniences to a shipping point, and the amount proposed to be donated by any locality and all other matters that may be of material advantage in the working of the same.

"Section 4. That this act take effect and be in force from and after its passage.

"Approved February 20, 1904."

Five days after the approval of the foregoing act an act providing for the establishment of a branch agricultural experimental station in the northwestern part of the state was approved. The act is as follows:

"AN ACT to provide for the establishment of a permanent branch agricultural station in the northwestern part of the state.[12]

"Section 1. Be it enacted by the Legislature of the State of Mississippi, That the board of trustees of the Mississippi Agricultural and Mechanical College, located near Starkville, are hereby authorized to establish a branch agricultural experiment station at some point in the northwestern part of the state, where experiments with the soils of the hill portion of the northwestern part of the state can be made. The said board of trustees are authorized to accept donations of land, lumber, agricultural implements, money, notes or other obligations or any property that may be of use in establishing and operating said experiment station.

"Section 2. The station herein provided for shall be on a tract of land not less than two hundred acres, and shall be located where suitable land is donated and conveyed to the trustees of said college for that purpose; and if lands in excess of two hundred acres are donated, the said board of trustees may, in their discretion, sell the same and apply to pro-

[12] Laws of Mississippi, 1904, S. B. No. 36, Chapter 84, p. 114.

ceeds to the improvement of the land retained and used for said experiment station.

"Section 3. In locating said station the said trustees shall consider the natural advantages, the health and conveniences to shipping point, and the amount proposed to be donated by any locality, and all other matters that may be of material advantage in the working of the same.

"Section 4. That this act take effect and be in force from and after its passage.

"Approved February 25, 1904."

Although the legislative acts quoted above authorized the establishment of two branch agricultural experiment stations, neither provided for the support or maintenance of their respective stations. Other action by the legislature was necessary; so on March 21, 1904, a bill was approved which appropriated three thousand dollars for the support of each of the two branch stations. The act in full is given here:

"AN ACT to make an appropriation for the support of the Branch Agricultural Experiment Stations to be located in the northwestern part of the State and in the Delta, or contiguous to the Delta, for the years 1904 and 1905.[13]

"Section 1. Be it enacted by the Legislature of the State of Mississippi, That the sum of three thousand dollars ($3,000) be, and the same is hereby appropriated out of any money in the State treasury not otherwise appropriated for the support of the Branch Experimental Sation in the northwestern part of the State of Mississippi, for the year 1904. And three thousand dollars ($3,000) for the support of the Branch Experimental Station in the Delta or contiguous to the Delta, for the year 1905.

"Section 2. That no part of said appropriation be drawn from said State treasury until after the donation required for the establishment and location of said stations in the Acts creating the same have been made and said stations located by the Board of Trustees of the Agricultural and Mechanical College, as required by said Acts of creation. All payments made from said appropriation shall be made upon such vouchers of the trustees of the Agricultural and Mechanical College and in the same manner as is provided for drawing support funds for said college.

"Section 3. That this Act take effect and be in force from and after its passage.

"Approved March 21, 1904."

THE DELTA BRANCH STATION

According to the legislative acts creating the branch agricultural experiment stations, a committee of the board of trustees in the summer of 1904 examined tracts of land in the Delta at many points,

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[13] Laws of Mississippi, 1904, S. B. No. 379, Chapter 9, p. 12.

but at no place were the people able to offer suitable land free of cost as provided for in the bill. About the first of December, 1904, the people of Washington county, realizing the importance of an experiment station in the Delta and the desirability of securing an experiment station in the county, raised $15,000 and bought 2,000 acres of land at Stoneville, where the Southern and the Y. and M. V. railroads cross, nine miles east of Greenville. The board met about the middle of December and accepted the proposition of the people (at Stoneville) of Washington county, and located the station at Stoneville. Mr. H. E. Saveley, a graduate of the College, class of 1903, was put in charge temporarily to get the land in good condition to begin work in earnest during the year 1906. As only $3,000 was appropriated, little could be done.

In 1906 Professor J. W. Fox, of the Department of Rural Engineering, was transferred to Stoneville and made assistant director in charge of the Delta Station.

From the very beginning the affairs of the station have progressed in a splendid manner. The necessary farm buildings, cabins for laborers, and cottages for the foreman and the director were erected, as the work of fencing and draining the station lands was being carried forward. Believing that the Delta people would be the victims of the boll weevil, just as the Texans of the Brazos bottom had been, Professor Fox began to teach them how to diversify in order that they would be prepared to meet what would otherwise have been the greatest calamity that ever befell an agricultural section. A considerable number of appropriate lines of investigation were begun, including work with cotton, corn, oats, wheat, alfalfa, cowpeas, red clover, fertilizers, rotation, cultivation, surface drainage, and hogs and crops suitable for them.

In 1910 a herd of Hereford cows and a few brood mares were added to the livestock. Professor Fox was made director of the central station in 1910, and Mr. G. B. Walker, another graduate of the College, class of 1907, was placed in charge of the Delta Station. The following year the station lands were overflowed twice, being under water a total of seventy days. This, with the unsettled labor conditions existing, caused a severe setback to the station work. During the two-year period of 1911 and 1912, three different foremen were employed. Each change, of course, had its disadvantages.

During the last few years the work of the Delta Station has been conducted on the same general lines as in previous years, but somewhat broadened in many respects. Studies in the varieties of corn and cotton have received a greater part of the Delta Station workers' attention. Small grains, livestock, forage and legume crops, horti-

cultural work, and drainage problems have also come in for their share of attention at the Delta Station.

A great many improvements have been made at the Delta Station. The grounds have been so laid out as to give more room and to permit of beautifying, while the old buildings have been rearranged and made into very attractive and comfortable quarters for the station employees. The sewer, lighting, and water systems have been enlarged, and a new modern residence for the director, which is in keeping with the best plantation homes, has just been completed. A group of hollow tile cabins for the farm laborers have also been erected. The station grounds are now well fenced, with a splendid system of concrete walks connecting all important buildings. The total amount expended by the Delta Station since its establishment in 1904 to date, including the biennial period of 1922-23, is $236,304.44. The source of the various amounts may be ascertained from the financial chart on page 36.

THE NORTH MISSISSIPPI BRANCH STATION

The location of the North Mississippi Branch Station, like other branch stations, was determined by a committee from the board of trustees of A. and M. College.[14] This committee, in the summer and fall of 1904, after making an examination of lands offered at Como, Water Valley, Grenada, and Holly Springs, decided that the offer made by Holly Springs was the most desirable, and that a station located there would be in a position to serve that section of the state most efficiently. No experimental work was done during 1904, since the money appropriated for the work, $3,000, was sufficient only for getting the land ready for real experimental work during the following year. Mr. R. S. Wilson, a graduate of the College, class of 1904, was put in temporary charge of the station. Owing to the fact that the land in the northern part of the state, especially around Holly Springs, was badly cut up by gullies, the first work was to reclaim the worn lands and to prevent the washing of hill lands. This was partially accomplished during the first year, and the following year the best land was put in corn and berries. The corn production was about forty (40) bushels to the acre. A fairly good start on an orchard of Elberta peaches was also made. In 1906, C. T. Ames (Mississippi A. and M., class of 1890) was made assistant director in charge of the Holly Springs station.

When the Holly Springs station was organized only $3,000 was available to carry on its work. Practically all of this amount was used in fencing and preparing the land for experiments. No money was available to build cottages for the station employees, so they were given the use of the old colored State Normal College buildings and

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[14] See Acts of Legislature, pages 25 and 26 for terms and conditions of organization.

grounds,[15] which lay just across the public road from the experiment station lands.

In June of 1905 the board of trustees decided to put the directors of the branch stations upon the same footing, so far as salary was concerned, with the heads of departments of the College. Accordingly the salaries of these men were raised to $2,000 a year. They have of course been increased since that time.

Fertilizer experiments were begun in 1906. In 1908 experiments with beef cattle and dairy cattle were begun with a view to utilizing the vast quantities of waste land in the northern section of the state.

The affairs of the Holly Springs station have progressed steadily since its establishment. The 1920 legislature was more liberal with the station than was any previous one. Several much needed implements, including a 15-30 h. p. Illinois tractor, with plows and a disk harrow, a motor cultivator, a culti-packer, a silage cutter, a milking machine, two-row corn and bean planters, and a few small tools, have been added. A one-hundred-ton concrete silo and a 2,500-bushel potato house have been erected. The milk house has been moved near the barn and properly equipped with separator, aerator, wash sink, and boiler. The separator was exchanged with the DeLaval people for a new one at a cost of freight both ways. Sixteen feet was added to the dairy barn and a 2 h. p. motor, with electric line to connect with the city power plant for current with which to run the milker, was installed. All the buildings on the grounds were painted during the summer of 1921.

The season of 1920 was very wet up until September, after which it was very dry. Much fall-sown grain was lost on account of the drouth.

Both the home economics and county agents of North Mississippi have held meetings at the station to the advantage of all concerned. Tate, Tallahatchie, and Union counties have brought large parties of farmers and high school students to visit this station. Interest centered about the dairy department, the terraces, and the potato house. Interest was also shown in the experiments with vetch or winter legumes. August 19, 1922, was Marshall County Day at the station. About 350 people were present.

Rather late in the spring of 1920, some simple experiments with fertilizers under cotton were started at the county sites and agricul-

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[15] A colored school located at Holly Springs by the Methodist Conference as Shaw University and incorporated by the State Legislature, May 26, 1870. The colored State Normal School was a part of Shaw University and the State had erected its own buildings and owned ten acres of land, adjoining the University grounds. The Senate Journal, 1873, Appendix pp. 992-1001, shows that the Legislature on April 15, 1873, appropriated $10,000 for the purchase of buildings and grounds for the colored Normal College.

tural high schools of the following counties: Lafayette, Tippah, Tate, Panola, Tallahatchie, Holmes, and DeSoto. The seasons were unfavorable, and poor results were obtained. It is thought that a simple experiment of this kind in each county, properly supervised and the results published in the regular bulletin form with the regular results of the central station, would be the means of the station's learning more of the requirements of each county and should make the bulletin more attractive to the public. Part of this work would be done by the assistant directors. If such work is placed with the agricultural high schools, special attention will have to be given to it, as has been taught by experience. They do not have the time, and the work will be neglected.

Several meetings have been held in each of the following counties: Marshall, Lafayette, Union, Tippah, Alcorn, Tishomingo, Prentiss, Lee, Tate, and Tallahatchie. Since the decline in the price of cotton, the station has been very popular. Experimental work with the following projects are under way at the Holly Springs Station: fertilizer, cotton, legumes, sweet potatoes, soil erosion, and dairy problems. A model home, with orchard, garden, and poultry yard, is also under construction.

COUNTY BRANCH AGRICULTURAL EXPERIMENT STATIONS

That the agricultural experiment stations have rendered a great and lasting service to the citizens of the state has been evident from their beginning, but it remained for the legislature of 1910 to break all records for enacting laws authorizing the establishment of additional stations. During that session of the legislature no less than five separate bills authorizing the establishment of additional agricultural experiment stations were passed. These acts were in addition to the laws making provision for the three branch stations already in operation. The first of the bills, approved January 29, 1910, authorized the establishment of a branch agricultural experiment station in the southwestern part of the state[16] south of the Alabama and Vicksburg Railroad and west of the Illinois Central Railroad. The second bill,[17] dated January 31, 1910, authorized the establishment of a branch agricultural experiment station in the eastern part of the state, on or east of the main line of the New Orleans, Mobile and Chicago Railroad, south of the Aberdeen branch of the Illinois Central, and north of the Alabama and Vicksburg Railroad. The third[18] was "an act authorizing and empowering the board of supervisors of Noxubee county, Mississippi, to appropriate five thousand dollars or any part thereof to aid in the purchase of land and material for establishing and equipping an agricultural experiment station in said county. This act was dated March 16, 1910.

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[16] Laws of Mississippi, 1910, Chapter 127, p. 116.
[17] Laws of Mississippi, 1910, Chapter 128, p. 117.
[18] Laws of Mississippi, 1910, Chapter 306, p. 266.

Right on the heels of the Noxubee act, under date of April 4, 1910, came a similar one from the legislators representing Neshoba, an adjoining county. It was an act to authorize the board of supervisors of Neshoba county in its discretion to buy and pay for a tract of land of not less than two hundred acres, and donate it to the state of Mississippi for an experiment station and to issue not more than six thousand dollars of bonds to pay for same if it so elects.[19] Each of the above acts specified that the branch experiment station was to be under the direction and control of the board of trustees of A. and M. College, but in no case was the state to contribute funds for its organization and operation. Consequently, the cry for branch stations was changed to petitions for stations to be operated and controlled entirely by the counties themselves.

To meet this demand the legislature immediately, April 8, 1910, passed a bill entitled "an act to provide for county experiment stations".[20] This act stated that the board of supervisors of any county in this state could establish a county agricultural experiment station and that its control should be vested in a director or trustee appointed by the county board of supervisors. Their funds were to be provided by the supervisors, either through appropriation from the general county funds or contributions from individuals and towns. The mere passage of these "letters of authorization" was not sufficient to build experiment stations. It required money, and not *one* of the counties in the state has ever taken advantage of the legislation that was made at their request. However, as a matter of fact, Warren county did make an offer in lands, but could not raise the necessary funds to equip the station. Noxubee and Jefferson counties did likewise.

The board of trustees, acting upon the advice of the Director of the Agricultural Experiment Stations and the President of the College, had for several years recommended to the legislature to establish branch stations in the southwest section of the state and in the prairie section, Noxubee county. In fact, the President of the College felt so sure that the legislature of 1910 would provide for a station at Macon that he had actually gone ahead and appointed an assistant director to take charge of the station.

The experiment stations, like all other public enterprises, have been subjected to some criticism and abuses. However, not until 1912 did any of the complaints receive any notice from the state legislature. At that time both houses of the legislature passed resolutions[21] calling for an investigation of the affairs of the three branch experiment stations, which were all state supported. A special committee, consisting of two members from the senate and three from the house, was appointed to make the investigation and to report back to the legis-

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[19] Laws of Mississippi, 1910, Chapter 209, p. 265.
[20] Laws of Mississippi, 1910, Chapter 130, p. 118.
[21] Laws of Mississippi, 1912, Chapter 457, p. 472.

lature in January, 1914. The investigation proved beneficial to the stations, as shown by the increased appropriations made by the 1914 legislature, to which body the report was made.

THE SOUTHWEST MISSISSIPPI BRANCH STATION

The 1920 legislature enacted laws providing for the establishment of an agricultural experiment station to be located at Raymond, Hinds county, in Southwest Mississippi. The acts in full are given below:

"AN ACT to provide for the establishment of a branch State Experiment Station in connection with the Hinds County Agricultural High School at Raymond, Mississippi.[22]

"Section 1. Be it enacted by the legislature of the State of Mississippi, That the board of trustees of the Mississippi Agricultural and Mechanical College, located at or near Starkville, are hereby authorized and directed to establish a branch agricultural experiment station at Raymond, Mississippi, in connection with the Hinds County Agricultural High School. The said board of trustees are authorized to accept donations of land, lumber, agricultural implements, fertilizers, money, notes or other obligations or any property or thing that may be of use in establishing and operating said experiment station, including leases of land for such periods as shall be acceptable to said board of trustees.

"Section 2. That said board of trustees are hereby authorized to purchase for the use of said experiment station not to exceed two hundred fifty acres of land to be situated as near as practicable to the property of the said Hinds County Agricultural High School and to erect such buildings and procure such equipment and implements as may be necessary for use of said station and in order to carry out the purposes for which it is established.

"Section 3. That this act take effect and be in force from and after its passage.

"Approved April 3, 1920."

"AN ACT making an appropriation for the establishment, equipment, and support of the Branch Agricultural Experiment Station at Raymond, Mississippi, established in connection with the Hinds County Agricultural High School.[23]

"Section 1. Be it enacted by the legislature of the State of Mississippi, That the following sums be appropriated for the establishment, equipment, and support of the Branch Agricultural Experiment Station at Raymond, Mississippi:

For purchase of land for use of station	$6,000.00
For buildings and permanent improvement and equipment for said station	6,000.00
For general support and equipment for 1920	5,000.00
For general support and equipment for 1921	5,000.00

"Section 2. That money hereby appropriated shall be

[22] Laws of Mississippi, 1920, Chapter 160, p. 160.
[23] Laws of Mississippi, 1920, Chapter 11, p. 20.

drawn from the state treasury under the direction of the board of trustees of the state Agricultural and Mechanical College, on certificate of the director of the experiment station, approved by the governor; provided, that the said director shall pay quarterly into the state treasury the gross proceeds from the sale of all products raised at the station, except such products as are necessary for forage and feed.

"Section 3. That this act take effect and be in force from and after its passage.

"Approved April 3, 1920."

Soon after the passage of the foregoing bills, the board of trustees, assisted by a committee of local citizens of Raymond, began looking for a suitable location. They purchased fifty acres of land known as the Williams tract. This place is one mile east of Raymond and sixteen miles southwest of Jackson and fronts along the gravel road connecting the two. It adjoins the farm of the Hinds County Agricultural High School, and also the property of the Hinds County Prison Farm. It was purchased for the sum of seven thousand five hundred dollars for the land and fifteen hundred dollars for a three-room cottage. In consideration of the board's purchasing this land, the Hinds County School Board deeded to the station thirty-nine acres off the High School tract adjoining it, and the board of supervisors deeded to it eighty acres off the county farm property. This makes a total of one hundred and sixty-nine acres owned by the station, all in one block and very desirably located.

Full possession of the land was not obtained until January 1, 1921, but the assistant director took charge as soon as the titles, deeds, etc., could be examined and recorded, and on September 24th began work. With the permission of the owner, building and improvements were started immediately. It was necessary that a station residence be built and that the cottage be moved to a more suitable location. Because of the extremely high price of both lumber and labor at that time, it was apparent that the available funds would allow only a very small residence; so it was decided to start a suitable residence and bring it as near completion as the funds would allow. Accordingly a modern six-room bungalow was begun, and enough of it has been finished to serve as a residence and office. About four thousand dollars was used for this purpose, and the other five hundred remaining of the building fund was used to move the cottage, rebuild foundation, chimneys, and flues, and make some minor repairs.

The support fund for the year 1920 was used in building a model barn to accommodate the work stock and provide ample room for hay storage; for salaries, feed, and office equipment; to purchase four mules, harness, a wagon, and a minimum amount of farm tools.

The support for 1921 was used for general support, that is, for salaries, labor, office expense, fertilizers, seed, and sundry supplies. In addition to this, the fund has been forced to cover the cost of some

fencing, feed for four mules, trees for a small orchard, a few farm tools that the station could not possibly do without, and various other items.

Before experimental work could be done the station staff had to solve the problem of drainage. Upon the best land there were several levees retarding the natural drainage; these have been cleaned up and partially worked down. There was also a winding ditch grown to willows and situated in the wrong place. A new canal has been started that will drain several acres too wet to cultivate, and small surface ditches have been made that will carry off any ordinary rainfall.

The outside fences, which were in bad condition, have been patched up enough to keep out cattle. A new fence has been built around the barn and orchard.

Much time was spent in 1921 in getting the plats laid off and put in condition for permanent experiments. It was necessary to study the uniformity of the soil in each plat and have both chemical and physical analyses made. Experimental work under way at present consists of: studies of various forms, amounts and combinations of nitrogen, phosphorus and potash carrier when used under cotton, corn, and tomatoes; studies of various crop rotations and their practical application to this type of soil; comparisons of different forms and amounts of lime; tests to determine the relative effect of soy beans, varieties of soy beans and velvet beans on the yield of corn; tests of nine and eleven varieties of cowpeas for both grain and hay; tests of four varieties of sorghum and three of millet to determine their relative productivity and their adaptability to this section; a study of grasses and clovers to determine the combinations best suited to this locality; studies of twenty varieties of early corn and fifteen varieties of late corn; a small orchard, consisting of eighty-four apple and peach trees, on which control measures of insects and diseases will be tried, and a study of varieties made; twenty-four varieties of long staple and short staple cotton; comparison of sweet potato varieties, also the yield of the late versus the early planted slips, and slips versus vines. Other than the strictly test plats, enough corn is being cultivated to supply feed for the work stock.

THE EXPERIMENT STATION FINANCES

Besides liberal appropriations for the branch experiment stations, the 1920 legislature made the first state appropriation for the support of the central station situated at the College. The amount appropriated by the state for the years 1920 and 1921 was $46,600. In 1922 the legislature appropriated $50,000 for the central station to be used during the current biennium, 1922-1923. The appropriations by the

state have enabled the central station to enlarge its work and be of greater service to the state.

Including the current biennial period (1922-1923), the Agricultural Experiment Stations in Mississippi have expended since their establishment the sum total of $1,761,221.29, divided among the various stations as follows:

Name of Station—	Federal Appropriation	State Appropriation	Sale of Farm Crops	Total by Stations
Central Station (A. and M. College)	$780,000.00	$ 96,600.00	$172,294.54	$1,048,894.54
South Mississippi Station (Poplarville)	----------	190,645.00	28,685.69	219,330.69
North Mississippi Station (Holly Springs)	----------	182,150.00	12,541.62	194,691.62
Delta Station (Stoneville)	----------	202,850.00	53,454.00	256,304.44
Southwest Mississippi Station (Raymond)	----------	42,000.00	----------	42,000.00
Total by sources	$780,000.00	$714,245.00	$266,976.29	$1,761,221.29

The total valuation of the property and equipment (1923) of the Agricultural Experiment Stations is $1,580,612.61, or $86,367.61 more than the total appropriations made to-date. This increase is due largely to the increased value of the property and the increase in the number of animals on the station farms. For ten years the funds derived from the sale of farm crops and animals were used to strengthen the farm herds, purchase implements, build barns, and make general farm improvements, but for a great many years the state has required that such funds be turned into the general treasury.

To the actual inventory of the station property and equipment, as expressed in dollars and cents, we should add the results of the research and investigations that have uncovered and verified the practical bearings of scientific agricultural facts and principles, whose value cannot be overestimated.

The financial sheet on page 36 shows when and from what sources the Agricultural Experiment Stations funds have come.

A complete list giving the personnel of the Mississippi Agricultural Experiment Station staff from its inception to-date (February 1, 1923) will be found beginning on page 37.

SOURCES OF REVENUE, MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

Year	Central Station at A. and M. College			South Miss. Station	North Miss. Station	Delta Station	Southwest Miss. Station	Yearly Totals All Stations
	U. S. Funds	State Funds	Total	State Funds	State Funds	State Funds	State Funds	All Funds
1888	$15,000.00		$15,000.00					$15,000.00
1889	15,000.00		15,000.00					15,000.00
1890	15,000.00		15,000.00					15,000.00
1891	15,000.00		15,000.00					15,000.00
1892	15,000.00		15,000.00					15,000.00
1893	15,000.00		15,000.00					15,802.17
1894	15,000.00	$ *802.17	15,802.17					17,629.57
1895	15,000.00	*2,629.57	17,629.57					15,880.51
1896	15,000.00	*880.51	15,880.51					15.000.00
1897	15,000.00		15,000.00					16,009.22
1898	15,000.00	*1,009.22	16,009.22					16,813.49
1899	15,000.00	*1,813.49	16,813.49					16,556.98
1900	15,000.00	*1,556.98	16,556.98					18,889.69
1901	15,000.00	*1,389.69	16,389.69	$*1,000.00 °1,500.00				
1902	15,000.00	*2,217.37	17,217.37	6,500.00				23,717.37
1903	15,000.00	*2,287.92	17,287.92	5,000.00				22,287.92
1904	15,000.00	*5,301.67	20,301.67	c3,937.35 6,500.00	$3,000.00	$3,000.00		36,739.02
1905	15,000.00		15,000.00	*4,823.48 6,500.00	3,000.00	*10.42 3,000.00		32,333.90
1906	20,000.00		20, 000.00	*2,185.16 4,105.82	*739.25 7,250.00	*2,064.04 5,000.00		41,344.27
1907	22,000.00		22,000.00	*2,185.17 4,105.82	*739.26 7,250.00	*2,064.04 5,000.00		43,344.29
1908	24,000.00	*5,300.06	29,300.06	*1,628.62 3,141.68	*860.36 3,250.00	*4,124.29 3,675.00		45,980.01
1909	26,000.00	*5,397.60	31,397.60	*1,628.62 3,141.68	*860.37 3,250.00	*4,124.30 3,675.00		48,077.57
1910	28,000.00	*5,080.09	33,080.09	*3,297.83 7,750.00	*1,665.61 9,025.00	*8,442.35 10,500.00		73,760.88
1911	30,000.00	*5,000.90	35,000.90	*1.874.46 7,500.00	9,025.00	10,500.00		63,900.36
1912	30,000.00		30,000.00	*2,500.00 7,900.00	*2,338.38 8,500.00	*1,875.00 11,250.00		64,363.38
1913	30,000.00		30,000.00	*2,500.00 7,900.00	*2,338.39 8,500.00	*750.00 11,250.00		63,238.39
1914	30,000.00	*4,600.81	34,600.81	*1,125.00 8,750.00	8,750.00	11,750.00		64,975.81
1915	30,000.00	*4,009.80	34,009.80	8,750.00	8,750.00	11,750.00		63,259.80
1916	30,000.00	*15,410.00	45,410.00	8,250.00	8,750.00	12,000.00		74,410.00
1917	30,000.00	*23,531.00	53,531.00	8,250.00	8,750.00	10,500.00		81,031.00
1918	30,000.00	*25,059.50	55,059.50	8,250.00	8,250.00	11,000.00		82,559.50
1919	30,000.00	*22,877.65	52,877.65	8,250.00	8,250.00	11,000.00		80,377.65
1920	30,000.00	*25,191.41 23,300.00	78,491.41	19,000.00	*1,500.00 19,000.00	*20,000.00 17,000.00	$17,000.00	171,991.41
1921	30,000.00	*10,947.13 23,300.00	64,247.13	19,000.00	*1,500.00 19,000.00	*10,000.00 17,000.00	5,000.00	135,747.13
1922	30,000.00	25,000.00	55,000.00	15,300.00	15,300.00	17,000.00	10,000.00	112,600.00
1923	30,000.00	25,000.00	55,000.00	15,300.00	15,300.00	17,000.00	10,000.00	112,600.00
Station Totals	$780,000.00	$268,894.54	$1,048,894.54	$219,330.69	$194,691.62	$256,304.44	$42,000.00	$1,761,221.29

*Sales Funds. °Appropriation made in 1902 but retroactive to 1901. cContributed.

PERSONNEL OF THE MISSISSIPPI AGRICULTURAL EXPERIMENT STATION FORCE

(To February 1, 1923)

Date of Appointment		Date Vacated
	Directors	
1888	S. M. Tracy, M. Sc.	1897
1897	W. L. Hutchinson, M. Sc.	1910
1910	J. W. Fox, M. Sc.	1911
1911	E. R. Lloyd, M. Sc.	1919
1919	J. R. Ricks, M. Sc.	----
	Assistant Directors	
1889	W. L. McGee, M. Sc.	1894
1894	E. R. Lloyd, M. Sc.	1911
1911	A. B. McKay, B. Sc.	1912
1912	J. R. Ricks, M. Sc.	1919
1919	H. B. Brown, Ph. D.	1921
	Assistant Directors in Charge of Branch Stations	
1900	E. B. Ferris, B. Sc. (South Mississippi Branch Station at Poplarville)	----
1906	J. W. Fox, B. Sc. (Delta Branch Station at Stoneville)	1910
1907	C. T. Ames, B. Sc. (Holly Springs Branch Station at Holly Springs)	----
1910	G. B. Walker, B. Sc. (Delta Branch Station at Stoneville)	1922
1920	C. B. Anders, B. Sc. (Raymond Branch Station at Raymond)	----
1920.	S. W. Greene, M. Sc. (Coastal Plains Branch Station at McNeil)	----
1922	W. E. Ayers, M. Sc. (Delta Branch Station at Stoneville)	----
	Temporary Managers of Branch Stations	
1905	R. S. Wilson, B. Sc. (Manager Holly Springs Branch Station)	1907
1905	H. E. Savely, B. Sc. (Manager Delta Branch Station)	1906
1905	John Phares (Manager McNeil Branch Station)	1907
	Agriculturists	
1888	F. A. Gulley, M. Sc.	1888
1888	B. Irby, M. Sc.	1889
1889	J. H. Connell, M. Sc.	1900
1900	E. R. Lloyd, M. Sc.	1906

Date of Appointment		Date Vacated
	Assistant Agriculturists	
1888	E. R. Lloyd, M. Sc.	1890
1904	J. R. Ricks, B. Sc.	1908
	Agronomists	
1906	W. R. Perkins, M. Sc.	1910
1910	J. W. Fox, M. Sc.	1911
1912	J. R. Ricks, M. Sc.	----
	Assistant Agronomists	
1910	J. R. Ricks, M. Sc.	1912
1922	Rowland Cowart, M. Sc.	----
	Horticulturists	
1888	A. B. McKay, B. Sc.	1889
1889	B. W. Stafford, B. Sc.	1890
1890	H. E. Weed, M. Sc.	1891
1891	A. B. McKay, M. Sc.	----
	Assistant Horticulturists	
1897	C. T. Ames, B. Sc.	1908
1905	D. C. Mooring, M. Sc.	1908
1905	G. L. Clothier, M. Sc.	1909
1909	H. C. Thompson, B. Sc.	1910
1910	B. W. Anspoon, M. Sc.	1912
1920	F. B. Richardson, B. Sc. (Poplarville Branch Station)	----
1921	J. C. C. Price, B. Sc.	----
	Meteorologists	
1888	B. W. Kilgore, M. Sc.	1889
1889	J. M. White, M. Sc.	1891
1894	J. S. Moore, M. Sc.	1900
1900	W. R. Perkins, M. Sc.	1910
1910	J. R. Ricks, M. Sc.	1916
1916	C. F. Briscoe, Ph. D.	----
	Geologists	
1910	W. N. Logan, Ph. D.	1916
1916	C. W. Tomlinson, Ph. D.	1917
1917	E. L. Packard, Ph. D.	1918
1918	W. C. Morse, M. Sc.	----

Date of Appointment		Date Vacated
	Entomologists	
1890	H. E. Weed, M. Sc.	1897
1897	G. W. Herrick, B. S. A.	1908
1909	R. W. Harned, B. S. A.	----
	Assistant Entomologists	
1908	R. W. Harned, B. S. A.	1909
1910	S. F. Blumenfeld, M. Sc.	1912
1912	R. N. Lobdell, M. Sc.	----
1914	C. E. Wilson, M. A.	1916
	Bacteriologists	
1908	R. P. Hibbard, Ph. D.	1912
1912	C. F. Briscoe, Ph. D.	----
	Associate Bacteriologist	
1920	H. H. Harned, M. Sc.	----
	Assistant Bacteriologist	
1914	H. H. Harned, M. Sc.	1920
	Botanists	
1907	G. W. Herrick, B. S. A.	1908
1910	G. L. Clothier, M. Sc.	1912
1912	H. B. Brown, Ph. D.	1915
1915	J. M. Beal, M. Sc.	----
	Assistant Botanists	
1891	J. M. White, M. Sc.	1892
1897	J. S. Moore, M. Sc.	1900
1909	G. L. Clothier, M. Sc.	1910
1913	J. M. Beal, M. Sc.	1915
	Plant Pathologists	
1916	R. V. Pettis, B. Sc.	1917
1920	D. C. Neal, B. Sc., M. A.	----
	Plant Breeders	
1910	E. C. Ewing, B. A., M. Sc.	1915
1915	H. B. Brown, Ph. D.	1921
1920	W. E. Ayers, B. Sc. (Delta Branch Station)	----
1921	J. T. O'Kelly, B. Sc.	----
	Chemists to Experiment Station	
1888	J. A. Myers, Ph. D.	1888
1888	W. L. Hutchinson, M. Sc.	1900
1900	W. R. Perkins, M. Sc.	1904
1904	W. F. Hand, Ph. D.	----

Date of Appointment		Date Vacated
	Associate Chemists	
1888	B. Von Herff, Ph. D.	1889
1888	L. G. Patterson	1894
1894	W. R. Perkins, M. Sc.	1897
1897	E. B. Ferris, M. Sc.	1900
1900	I. D. Sessums, B. Sc.	1921
	Veterinarians	
1888	D. L. Phares, M. D.	1889
1889	G. C. Creelman, B. Sc.	1891
1891	Tait Butler, V. S.	1896
1896	J. C. Robert, V. M. D.	1908
1908	James Lewis, V. M. D.	1911
1911	E. M. Ranck, D. V. M.	1920
1920	K. U. Jones, B. Sc., D. V. S.	----
	Assistant Veterinarians	
1910	E. H. Archer, D. V. S.	1912
1919	K. U. Jones, B. Sc., D. V. S.	1920
	Dairy Husbandman	
1900	J. S. Moore, M. Sc.	----
	Assistant Dairy Husbandmen	
1916	E. P. Gulledge, B. Sc.	1917
1917	A. S. Ambrose, B. Sc.	1919
1919	F. H. Herzer, B. Sc.	1922
1920	Earle Brintnall, B. Sc.	----
	Poultry Husbandmen	
1904	R. N. Crane	1907
1907	J. P. Kerr	1908
1910	W. F. Kirkpatrick, B. E., B. Agri.	1911
1911	Arthur E. Rolf	1912
1912	J. K. Morrison, B. P.	1914
1914	E. P. Clayton	----
	Animal Husbandmen	
1905	A. Smith	1909
1909	J. A. McLean	1910
1916	H. K. Gayle, B. Sc.	1919
1919	D. J. Griswold, B. Sc., A. M.	1921
1921	Enoch Barnett, V. M. D.	----
1921	C. J. Goodell, B. Sc.	----

Date of Appointment		Date Vacated
	Assistant Animal Husbandmen	
1900	A. Smith	1909
1909	J. S. Jerden, B. Sc.	1915
1915	W. C. Gill (Herdsman)	1916
1915	N. F. Hanson, B. Sc.	1916
1915	B. E. Webb (Horseman)	1916
1916	F. O. Montague	1918
1918	G. N. Creeland	1919
1918	S. W. Greene	1920
1918	W. H. Rochester	1919
1918	B. C. Maxwell (Horses and Mules)	----
1918	F. J. Tebbs (Beef Cattle)	1920
1918	M. E. Winfield (Hogs and Sheep)	1920
1920	D. Maxwell (Beef Cattle)	----
	Superintendents of Livestock	
1912	J. C. Kean	1918
1918	P. D. Snider	1920
	Superintendent of Farm	
1912	D. W. McIlwain	----
	Farm Foremen (Central Station)	
1912	A. E. Terry	1913
1913	Eugene Butler, B. Sc.	1914
1914	M. D. Reed, B. Sc.	1915
1918	H. G. Bounds	1920
	Farm Foremen (Branch Stations)	
1915	B. V. Evans (South Mississippi Branch Station)	----
1915	J. S. McBee, B. Sc. (Holly Springs Branch Station)	1917
1915	M. D. Reed, B. Sc. (Delta Branch Station, Stoneville)	1917
1917	H. McCorkle (Holly Springs Branch Station)	1920
1918	Haywood Johnson (Delta Branch Station, Stoneville)	1921
1920	J. C. Ryan (Holly Springs Branch Station)	----
1920	R. M. Rea, B. Sc. (Delta Branch Station, Stoneville)	1921
1920	H. F. Wallace, B. Sc. (Holly Springs Branch Station)	----
1921	I. P. Trotter, B. Sc., M. Sc. (Delta Branch Station)	1922
1922	K. C. Livingston (Delta Branch Station)	----
1922	L. P. Peyton (Raymond Branch Station)	----
	Agricultural Economist	
1920	J. N. Lipscomb, M. Sc.	----
	Associate Agricultural Economist	
1920	M. E. Andrews, B. Sc.	----
	Superintendent, Farm Management Vocational Project	
1922	F. O. Cork, B. Sc.	----

Date of Appointment		Date Vacated
	Agricultural Editor	
1920	A. C. Walthall	1922
	Fellows in Agriculture	
1903	S. A. Robert, B. Sc.	1904
1920	I. P. Trotter, A. B., B. Sc. (Agronomy)	1921
1920	M. C. Billingsley, B. Sc. (Animal Husbandry)	1921
1920	J. T. O'Kelly, B. Sc. (Plant Breeding)	1921
1922	R. G. Reeves, B. Sc.	----
	Collaborators	
1921	H. B. Brown, Ph. D. (Plant Breeder at Weilenman)	----
1921	E. C. Ewing, M. S c.(Plant Breeder at Scott)	----
	Agricultural Engineers	
1910	D. Scoates, B. Sc.	1920
1920	E. R. Gross, B. Sc.	1922
1922	W. C. Howell, B. Sc.	1922
	Associate Agricultural Engineer	
1920	Frank D. Cottrell	1922
	Drainage Engineer	
1913	A. G. Hall, B. C. E.	1915
	Treasurers	
1888	T. F. Watson	1890
1890	W. C. McGee, M. Sc. (Acting)	1890
1904	A. J. Moore	1912
1912	W. J. Jennings	1920
1920	C. B. Powell	1920
1920	M. H. Moore, C. P. A.	----
	Stenographers	
1898	W. H. Pickard	1899
1899	J. A. Turnipseed	1901
1901	Miss Maud Butler	1909
1906	E. M. Dodd	1909
1909	Miss Willie Sidney Gay, A. B.	1918
1917	Miss Loui Lloyd, A. B.	1917
1918	Miss Annie Dee Gladney, A. B.	1920
1920	Miss Kittie Sue Johnson, A. B.	----
1920	Miss Mary Alice Lanier	----
1922	Miss Pattie Snow Felton	1922
1922	Mrs. J. C. McKee, A. B.	1922
1922	Miss Fannie Page	----

LIST OF PUBLICATIONS ISSUED BY THE MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

(To March 1, 1923)

(Available publications are marked *)

(1) Mississippi Agricultural Experiment Station Bulletins

Bulletin Number—Title—Date of Publication—Author.

1. Organization, March 21, 1888—S. M. Tracy.
2. Cotton Worm, May 20, 1888—S. M. Tracy.
3. Analyses of Commercial Fertilizers, June 20, 1888—J. A. Myers.
4. The Marls of Mississippi, November 7, 1888—W. L. Hutchinson.
5. Fertilizers, May 20, 1889—S. M. Tracy.
6. Charbon, June 25, 1889—S. M. Tracy.
7. Hay Presses, June 20, 1889—S. M. Tracy.
8. Stock Feeding, August 30, 1889—B. Irby.
9. Diseases of Sheep and Calves; Bitter Weed, August 30, 1889—D. L. Phares.
10. Dishorning, October 10, 1889—D. L. Phares.
11. Charbon, February 15, 1890—G. C. Creelman.
12. Cotton Leaf Worm, June 25, 1890—S. M. Tracy.
13. Feeding for Milk and Butter, September 25, 1890—E. R. Lloyd.
14. Injurious Insects, March, 1891—H. E. Weed.
15. Feeding; Milk Testing Apparatus, June, 1891—E. R. Lloyd and L. G. Patterson.
16. Glanders, September, 1891—Tait Butler.
17. Insects Injurious to Stored Grain, December, 1891—H. E. Weed.
18. Varieties of Corn, January, 1892—E. R. Lloyd.
19. The Southern Tomato Blight, January, 1892—B. D. Halsted.
20. Grasses and Forage Plants, February, 1892—S. M. Tracy.
21. I. Insects Injurious to Cabbage. II. A New Method for Testing Milk. III. Feeding for Milk and Butter; June, 1890—H. E. Weed, L. G. Patterson, E. R. Lloyd.
22. Grapes, September, 1892—S. M. Tracy and F. S. Earle.
23. Varieties of Cotton, February, 1893—E. R. Lloyd.
24. Fertilizers for Cotton, February, 1893—W. L. Hutchinson and L. G. Patterson.
25. Colic in Horses and Mules, June, 1893—Tait Butler.
26. Small Fruits, August, 1893—A. B. McKay.
27. Insecticides and Their Application, November, 1893—H. E. Weed.
28. The Horn-Fly, January, 1894—H. E. Weed.
29. Exhaustion and Restoration of Soil Fertility; Fertilizers and Their Use, May, 1894—W. L. Hutchinson.
30. A Kerosene Attachment for Knapsack Pumps, May, 1894—H. E. Weed.
31. Lameness in Horses and Mules, September, 1894—Tait Butler.
32. A New Kerosene Attachment for Knapsack Sprayers, December, 1894—H. E. Weed.

33. Corn, March, 1895—S. M. Tracy and E. R. Lloyd.
34. Mississippi Fungi, May, 1896—S. M. Tracy and F. S. Earle.
35. Hog Raising, September, 1895—Tait Butler.
36. Insects Injurious to Corn, November, 1895—H. E. Weed.
37. Fruits and Vegetables on the Gulf Coast, March, 1896—F. S. Earle.
38. Mississippi Fungi, May, 1896—S. M. Tracy and F. S. Earle.
39. Feeding for Beef, August, 1896—E. R. Lloyd and J. S. Moore.
40. The Cow Pea, December, 1896—S. M. Tracy and E. R. Lloyd.
41. The Colorado Potato Beetle in Mississippi, March, 1897—H. E. Weed.
42. (a). Acclimation Fever, or Texas Fever, November, 1897—J. C. Robert.
42. (b). Analyses of Commercial Fertilizers, January, 1898—B. W. Kilgore.
43. Natural Plant Food, Claims Made For It and Its Value, February 15, 1898—B. W. Kilgore.
44. Winter Pasture, January, 1898—E. R. Lloyd.
45. Analyses of Commercial Fertilizers, February 15, 1898—B. W. Kilgore.
46. Co-operative Experiments With Small Fruit, March, 1896—D. T. Price.
47. Analyses of Commercial Fertilizers, March 25, 1898—B. W. Kilgore.
48. Analyses of Commercial Fertilizers, May 1, 1898—B. W. Kilgore.
49. Analyses of Commercial Fertilizers, June 25, 1898—B. W. Kilgore.
50. Winter and Summer Pasture in Mississippi, September, 1898—E. R. Lloyd.
51. Analyses of Commercial Fertilizers, January 15, 1899—B. W. Kilgore.
52. Analyses of Commercial Fertilizers, February 15, 1899—B. W. Kilgore.
53. Some Insects Injurious to Stock and Remedies Therefor, March, 1899—Glenn W. Herrick.
54. Irish Potato Culture, March, 1899—A. B. McKay.
55. Analyses of Commercial Fertilizers, March 15, 1899—B. W. Kilgore.
56. Grapes, April, 1899—J. S. Moore.
57. Analyses of Commercial Fertilizers, April, 1899—B. W. Kilgore.
58. Soils of Mississippi: Texture and Water Conditions, May, 1899—W. L. Hutchinson.
59. Analyses of Commercial Fertilizers, June 15, 1899—B. W. Kilgore.

60. Value of Cotton Seed to the Farmer, September, 1899—E. R. Lloyd, E. B. Ferris, W. L. Hutchinson, W. R. Perkins, J. S. Moore.
61. Analyses of Commercial Fertilizers, January 15, 1899—W. F. Hand.
62. Varieties of Cotton, April, 1900—E. R. Lloyd.
63. Inoculation of Soils, June, 1900—Glenn W. Herrick.
64. Analyses of Commercial Fertilizers, August 15, 1900—W. F. Hand.
65. Soils of Mississippi: Chemical and Physical Composition, June, 1900—W. L. Hutchinson, W. R. Perkins, E. B. Ferris.
66. Soils of Mississippi: Plant Food and Productiveness, February, 1901—W. L. Hutchinson.
67. Good Dirt Roads for Mississippi, April, 1901—J. W. Fox and W. L. Hutchinson.
68. Analyses of Commercial Fertilizers, September 1, 1901—W. F. Hand.
69. Texas Fever, November, 1901—J. C. Robert.
70. I. Records of Station Cows. II. Feeding Dairy Cows, December, 1901—J. S. Moore.
71. Milk Fever, January, 1902—J. C. Robert.
72 Anthrax, January, 1902—J. C. Robert.
73. Tick Fever or Murrain in Southern Cattle, July, 1902—J. C. Robert.
74. Some Mosquitoes of Mississippi and How to Deal With Them, November, 1901—Glenn W. Herrick.
75. Strawberry Culture in Mississippi, January, 1902—A. B. McKay.
76. Beef Cattle, July, 1902—W. L. Hutchinson and E. R. Lloyd.
77. Analyses of Commercial Fertilizers, September 1, 1902—W. L. Hutchinson.
78. The Chicken Mite, October, 1902—Glenn W. Herrick.
79. Report of Work Done at McNeil Branch Experiment Station for 1902, January, 1903—E. B. Ferris.
80. Farmers' Institute Bulletin, 1902, March, 1903—W. L. Hutchinson.
81. The Colorado Potato Beetle, June, 1903—Glenn W. Herrick.
82. Inspection and Analyses of Commercial Fertilizer, July, 1903 —W. F. Hand.
83. Report of Work Done at McNeil Branch Experiment Station for 1903, January, 1904—E. B. Ferris.
84. Report of Field Work at the College Station for 1903.
85. Inspection and Analyses of Commercial Fertilizer, July, 1904—W. F. Hand.
86. Insects Injurious to Pecans, November, 1904—Glenn W. Herrick.
87. Report of Work at McNeil Branch Experiment Station for 1904, January, 1905—E. B. Ferris.

88. Report of Field Work Done at the College Station for 1904, January, 1905.
89. Underground Waters of Mississippi, January, 1905—W. N. Logan and W. R. Perkins.
90. The San Jose Scale in Mississippi, and the Lime-Salt-Sulphur Wash, August, 1905—Glenn W. Herrick.
91. Inspection and Analyses of Commercial Fertilizers, September, 1905—W. F. Hand.
92. Feeding Beef Cattle in Mississippi, August, 1905—A. Smith and C. I. Bray.
93. Peach and Plum Culture, September, 1905—A. B. McKay.
94. Report of Work at McNeil Branch Experiment Station for 1905, January, 1906—E. B. Ferris.
95. The Dairy Cow, April, 1906—J. S. Moore.
96. Insects and Diseases Liable to Be Introduced Into Mississippi, February, 1906—Glenn W. Herrick.
97. Inspection and Analyses of Commercial Fertilizer, March, 1906 —W. F. Hand.
98. Varieties of Cotton, 1905 and 1906, January, 1907—W. R. Perkins.
99. Fertilizers, January, 1907—E. B. Ferris.
100. Farmers' Institute Bulletin, December, 1906—E. R. Lloyd.
101. Report of Work at McNeil Branch Experiment Station for 1906, January, 1907—E. B. Ferris.
102. How to Control Injurious Insects and Noxious Plant Diseases, April, 1907—Glenn W. Herrick.
103. Farmers' Institute Bulletin, 1907, July, 1907—W. R. Perkins.
104. Inspection and Analyses of Cottonseed Meal, August, 1907— W. F. Hand.
105. Inspection and Analyses of Commercial Fertilizers, November, 1907—W. F. Hand.
106. Report of Work at Delta Branch Experiment Station for 1906, January, 1907—J. W. Fox.
107. Pork Production at the Delta Station, February, 1909—J. W. Fox.
108. Report of Work at the Holly Springs Branch Experiment Station for 1906, January, 1908—C. T. Ames.
109. Farmers' Institute Bulletin, April, 1908—G. L. Clothier.
110. Report of Work at Holly Springs Branch Experiment Station for 1907, January, 1908—C. T. Ames.
111. Experiments in Feeding Dairy Cows, January, 1908—J. S. Moore.
112. Silage vs. Hulls and Meal, April, 1908—A. K. Risser and R. R. Welch.
113. Cotton Experiments, 1907, June, 1908—W. R. Perkins.
114. Inspection and Analyses of Cottonseed Meal, November, 1908 —W. F. Hand.

115. Inspection and Analyses of Commercial Fertilizers, November, 1908—W. F. Hand.
116. Varieties of Cotton, 1908, December, 1908—W. R. Perkins.
117. Cotton Culture in Mississippi, December, 1908—W. L. Hutchinson.
118. Clearing Pine Lands, January, 1909—E. B. Ferris.
119. Report of Work at the Delta Branch Experiment Station, 1907-March, 1908—J. W. Fox.
120. Farmers' Institute Bulletin, 1908—E. R. Lloyd.
121. Experiments in Feeding Beef Steers, July, 1909—J. A. McLean.
122. Report of Work at the Holly Springs Experiment Station for 1908, July, 1909—C. T. Ames.
123. Inspection and Analyses of Commercial Feeding Stuffs, June, 1909—W. F. Hand.
124. Pecan Culture, October, 1909.
125. Inspection and Analyses of Commercial Feeding Stuffs, November, 1909—W. F. Hand.
126. Inspection and Analyses of Commercial Fertilizers, November, 1909—W. F. Hand.
127. Inspection and Analyses of Cottonseed Meal, December, 1909—W. F. Hand.
128. Inspection and Analyses of Cottonseed Meal, April, 1910—W. F. Hand.
129. Sugar Cane for Syrup Making, December, 1909—E. B. Ferris.
130. Peanuts, December, 1909—E. B. Ferris.
131. Snap Beans, December, 1909—E. B. Ferris.
132. The Soils of Mississippi, January, 1910—W. L. Hutchinson.
133. The Inspection and Analyses of Commercial Feeding Stuffs, January, 1910—W. F. Hand.
134. Broom Corn, January, 1910—W. R. Perkins.
135. Cotton, 1909, January, 1910—W. R. Perkins.
136. Feeding Beef Steers on Cottonseed Meal, on Pasture, March, 1910—J. A. McLean.
137. Inspection and Analyses of Commercial Feeding Stuffs, April, 1910—W. F. Hand.
138. Inspection and Analyses of Commercial Feeding Stuffs, May, 1910—W. F. Hand.
139. Boll Weevil in Mississippi, 1909, March, 1910—R. W. Harned.
*140. Cotton Diseases in Mississippi, July, 1910—R. P. Hibbard.
141. Control of Diseases of Flowers, Vegetables, and Fruits, June, 1910—H. C. Thompson.
142. Inspection and Analyses of Commercial Feeding Stuffs, November, 1910—W. F. Hand.
143. Inspection and Analyses of Cottonseed, December, 1910—W. F. Hand.
144. Inspection and Analyses of Commercial Feeding Stuffs, December, 1910—W. F. Hand.

145. Inspection and Analyses of Commercial Feeding Stuffs, December, 1910—W. F. Hand.
*146. Suggestions for Growing Home Fruits, March, 1911—A. B. McKay.
*147. Apple Growing in Mississippi, April, 1911—H. C. Hand.
148. Inspection and Analyses of Cottonseed Meal, July, 1911—W. F. Hand.
149. Inspection and Analyses of Commercial Feeding Stuffs, October, 1911—W. F. Hand.
150. Inspection and Analyses of Commercial Fertilizers, October, 1911—W. F. Hand.
151. Inspection and Analyses of Cottonseed Meal, July, 1911—W. F. Hand.
152. Inspection and Analyses of Commercial Feeding Stuffs, November, 1911—W. F. Hand.
153. Inspection and Analyses of Commercial Feeding Stuffs, November, 1911—W. F. Hand.
154. Inspection and Analyses of Commercial Feeding Stuffs, December, 1911—W. F. Hand.
155. Recent Cotton Experiments, December, 1911—J. W. Fox, J. R. Ricks, and E. C. Ewing.
156. Inspection and Analyses of Cottonseed Meal, April, 1912—W. F. Hand.
157. Report of Work at the Delta Branch Experiment Station for 1911, February, 1912—G. B. Walker.
158. Report of Work at the McNeil Branch Experiment Station for 1907-11, January, 1912.
159. Clearing Pine Lands, January, 1912—E. B. Ferris.
160. The Cut-Over Lands of South Mississippi, January, 1912—E. B. Ferris.
161. Cotton Experiments, 1912, February, 1913—J. R. Ricks and E. C. Ewing.
162. Cottonseed Meal As a Feed For Laying Hens, September, 1913 J. K. Morrison.
163. Truck Crops for South Mississippi, 1913—E. B. Ferris.
*164. Cotton Experiments, 1913, February, 1914—J. R. Ricks.
165. Report of the Work Done at Holly Springs Branch Experiment Station, 1913, January, 1914—C. T. Ames.
166. Dairying on Cut-Over Lands, 1913—E. B. Ferris.
167. Corn Silage Compared With Hulls for Fattening Steers, October, 1914—E. R. Lloyd.
*168. Bacteriological Effects of Green Manures, January, 1915—C. F. Briscoe and H. H. Harned.
*169. Cotton Experiments, 1914, December, 1914—C. T. Ames.
*170. Corn, January, 1915—J. R. Ricks.
171. Small Grains, January, 1915—J. R. Ricks.
172. Forage Crops, January, 1915—J. R. Ricks.
*173. Cotton Experiments, 1915, January, 1916—H. B. Brown.
174. Dairy Bulletin, 1914—J. S. Moore.

*175. Cottonseed Meal: A Good Feed for Laying Hens, August, 1916—E. P. Clayton.
*176. Economy of Mule Production in the South and Methods of Managements, April, 1916—H. K. Gayle and E. R. Lloyd.
*177. Hog Feeding at the Delta Branch Experiment Station, August, 1916—G. B. Walker.
178. Cotton Experiments, 1915, December, 1916—J. R. Ricks, H. B. Brown, G. B. Walker, and C. T. Ames.
*179. Velvet Beans, August, 1917—E. B. Ferris.
*180. Pasture and Forage for South Mississippi, August, 1917—E. B. Ferris.
*181. Emergency Cow Feeds, August, 1917—H. K. Gayle.
*182. Feeding of Different Silages to Fattening Steers, June, 1917—H. K. Gayle and E. R. Lloyd.
*183. Calf and Baby Beef Feeding, September, 1917—H. K. Gayle.
*184. Cotton Experiments, 1917, February, 1918—H. B. Brown and C. T. Ames.
*185. Bacteriological Effects of Green Manures, Study No. 11, July, 1918—C. F. Briscoe and H. H. Harned.
*186. Cotton Experiments, 1918, March, 1919—H. B. Brown.
*187. Cotton Experiments in 1920, December, 1920—H. B. Brown and C. B. Anders.
*188. Report on McNeil Branch Experiment Station, December, 1920—E. B. Ferris.
*189. Corn at Holly Springs Branch Experiment Station, December 15, 1920—C. T. Ames.
*190. Sweet Potato Diseases and Their Control, December 15, 1920—D. C. Neal.
*191. Mosaic Diseases of Sugar Cane, December, 1920—L. E. Miles.
*192. Cotton at North Mississippi Branch Experiment Station, December, 1920—C. T. Ames.
*193. Annual Report, North Mississippi Branch Station, December, 1920—C. T. Ames.
*194. Report, South Mississippi Branch Station, December, 1920—E. B. Ferris.
*195. Dusting and Spraying Peaches, December, 1920—O. I. Snapp.
*196. Cotton Experiments in South Mississippi, December, 1920—E. B. Ferris.
*197. Corn Experiments, Central Station, January, 1921—H. B. Brown
*198. Corn Variety Tests, Delta Branch Station, January, 1921—W. E. Ayers.
*199. Sugar Cane for Syrup Making, February, 1921—E. B. Ferris.
*200. Dairy Calves, Feed and Care, July, 1921—Earle Brintnall.
*201. Report from South Mississippi Branch Experiment Station for 1921, January, 1922—E. B. Ferris. (This bulletin was erroneously dated 1922. It should bear the date of December, 1921.)

*202. Report from Holly Springs Branch Experiment Station for 1921, December, 1921—C. T. Ames.
*203. Spraying Experiments for the Control of Pecan Scab in Mississippi, December, 1921—D. C. Neal.
*204. 1920 and 1921 Experiments with Poultry, December, 1921—E. P. Clayton and J. P. Clayton.
*205. Cotton Experiments, December, 1921—H. B. Brown and J. F. O'Kelly.
*206. The Sweet Potato for South Mississippi, December, 1921—E. B. Ferris and F. B. Richardson.
*207. Nitrogenous Fertilizer Experiments, Delta Branch Station, April, 1922—G. B. Walker, E. C. Ewing, and Ide P. Trotter.
*208. Peanuts, March, 1922—E. B. Ferris.
*209. Alfalfa in the Delta, February, 1922—G. B. Walker.
*210. Vegetables and Truck for Home Use, March, 1922—W. E. Ayers
*211. Report from Holly Springs Branch Station for 1922, January, 1923—C. T. Ames.
*212. Cotton Spacing, January, 1923—H. B. Brown.
*213. Report from Raymond Branch Experiment Station for 1920 to 1922, Inclusive, January, 1923—C. B. Anders.
*214. Varying Proportions of Corn and Cottonseed Meal Fed with Silage for Finishing Beef Steers, January, 1923—Enoch Barnett and C. J. Goodell.
*215. Cotton Experiments 1922, Delta Branch Experiment Station, December, 1922—W. E. Ayres.

(2) Mississippi Agricultural Experiment Station Technical Bulletins

1. A Chemical Study of the Cotton Plant, December, 1892—W. L. Hutchinson and L. G. Patterson.
*2. Some Scale Insects of Mississippi, February, 1911—Glenn W. Herrick.
*3. Form and Structure of Certain Plant Hybrids in Comparison with the Form and Structure of Their Parents, January, 1913 H. B. Brown.
4. The Soils of Mississippi, 1913—W. N. Logan.
*5. Sero-Diagnosis of Pregnancy in Mares, 1914—C. F. Briscoe and E. M. Ranck.
*6. Forage Poisoning Due to Claviseps Paspali on Paspalum, February, 1915—H. B. Brown and E. M. Ranck.
*7. Soils in Mississippi, 1916—W. N. Logan.
8. A Study of Certain Environmental Factors and Varietal Differences Influencing the Fruiting of Cotton, June, 1918—E. C. Ewing.
*9. North American Ipadie, December, 1920—M. W. Blackman.
*10. Descriptions of Eight New Bark Beetles (Ipadæ) from Mississippi, May, 1921—M. W. Blackman.
*11. Mississippi Bark Beetles, July, 1922—M. W. Blackman.

(3) Mississippi Agricultural Experiment Station Circulars

1. Analysis of Commercial Fertilizers on Sale in the State, January, 1900—W. L. Hutchinson.
2. Analysis of Commercial Fertilizers on Sale in the State, February, 1900—W. L. Hutchinson.
3. Analysis of Commercial Fertilizers on Sale in the State, March, 1900—W. L. Hutchinson.
4. Analysis of Commercial Fertilizers on Sale in the State, January, 1901—W. L. Hutchinson.
5. Analysis of Commercial Fertilizers on Sale in the State, February, 1901—W. L. Hutchinson.
6. Analysis of Commercial Fertilizers on Sale in the State, March, 1901—W. L. Hutchinson.
7. Analysis of Commercial Fertilizers on Sale in the State, January, 1902—W. L. Hutchinson.
8. Analysis of Commercial Fertilizers on Sale in the State, February, 1902—W. L. Hutchinson.
9. Analysis of Commercial Fertilizers on Sale in the State, March, 1902—W. L. Hutchinson.
10. Analysis of Commercial Fertilizers on Sale in the State, February, 1903—W. F. Hand.
11. Analysis of Commercial Fertilizers on Sale in the State, March, 1903—W. F. Hand.
12. Inspection and Analysis of Commercial Fertilizers on Sale in the State, April, 1903—W. F. Hand.
13. Inspection and Analysis of Commercial Fertilizers on Sale in the State, January, 1904—W. F. Hand.
14. Inspection and Analysis of Commercial Fertilizers on Sale in the State, February, 1904—W. F. Hand.
15. Inspection and Analysis of Commercial Fertilizers on Sale in the State, March, 1904—W. F. Hand.
16. Inspection and Analysis of Commercial Fertilizers on Sale in the State, February, 1905—W. F. Hand.
17. The Mexican Cotton Boll Weevil, February, 1905—Glenn W. Herrick.

18. (a) Alfalfa, March, 1904—W. R. Perkins.

18. (b) Inspection and Analyses of Commercial Fertilizers on Sale in the State, March, 1905—W. F. Hand.

19. (a) Strawberry Culture in Mississippi, April, 1904—A. B. McKay.

19. (b) Inspection and Analysis of Commercial Fertilizer on Sale in the State, January, 1906—W. F. Hand.

20. Inspection and Analysis of Commercial Fertilizer on Sale in the State, February, 1906—W. F. Hand.
21. Inspection and Analysis of Commercial Fertilizer on Sale in the State, March, 1906—W. F. Hand.
22. Inspection and Analysis of Commercial Fertilizer on Sale in the State, January, 1907—W. F. Hand.

23. Inspection and Analysis of Commercial Fertilizer on Sale in the State, March, 1907—W. F. Hand.
24. Inspection and Analysis of Commercial Fertilizer on Sale in the State, April, 1907—W. F. Hand.
25. Inspection and Analysis of Commercial Fertilizer on Sale in the State, February, 1908—W. F. Hand.
26. Inspection and Analysis of Commercial Fertilizer on Sale in the State, March, 1908—W. F. Hand.
27. Inspection and Analysis of Commercial Fertilizer on Sale in the State, February, 1909—W. F. Hand.
28. Inspection and Analysis of Commercial Fertilizer on Sale in the State, March, 1909—W. F. Hand.
29. Inspection and Analysis of Commercial Fertilizer on Sale in the State, April, 1909—W. F. Hand.
30. Inspection and Analysis of Commercial Fertilizer on Sale in the State, February, 1910—W. F. Hand.
31. Inspection and Analysis of Commercial Fertilizer on Sale in the State, March, 1910—W. F. Hand.
32. Inspection and Analysis of Commercial Fertilizer on Sale in the State, February, 1911—W. F. Hand.
33. Inspection and Analysis of Commercial Fertilizer on Sale in the State, May, 1911—W. F. Hand.
34. Inspection and Analysis of Commercial Fertilizer on Sale in the State, April, 1912—W. F. Hand.

*35. Cultural Experiments with Cotton, January, 1921—G. B. Walker and W. E. Ayers.

*36. Varieties of Cotton, 1919-1920, and Summary of Ten Years' Work, 1911-1920, Delta Station, January, 1921—W. E. Ayers.

*37. Why Not Plant Home Grown Cotton Seed? March, 1921—H. B. Brown.

*38. Blackstrap Molasses for Dairy Cattle, July, 1921—Earle Brintnall.

*39. Cost of Producing Truck in Copiah County in 1921, September, 1921—J. N. Lipscomb.

*40. Correlation Between the Yield and Prolificness of Corn Varieties Grown in Mississippi, December, 1921—H. B. Brown and J. F. O'Kelly.

*41. Apples in North Mississippi, December, 1921—J. C. C. Price and C. T. Ames.

42. Withdrawn before publication and issued as Bulletin Number 205.

*43. Alfalfa Culture, December, 1921—C. T. Ames.

*44. Grapes in Mississippi, December, 1921—J. C. C. Price.

*45. Cotton Experiments, 1922, Central Station, December, 1922—J. F. O'Kelly and Rowland Cowart.

*46. Cotton Experiments, 1922, South Mississippi Branch Station, January, 1923—E. B. Ferris.

*47. Corn Experiments, 1922, Central Station, January, 1923—J. F. O'Kelly and Rowland Cowart.

(4) Mississippi Agricultural Experiment Station Miscellaneous Circulars

Hairy Vetch, 1905—E. R. Lloyd.
Asparagus Culture, 1905—A. B. McKay.
Underground Waters in Mississippi, 1905—W. N. Logan.
Black Leg, 1906—J. C. Robert.
The Boll Weevil, September, 1907—Glenn W. Herrick.
The Insect Pest Law, June, 1908—Glenn W. Herrick.
Tuberculosis in Dairy, August, 1912—E. M. Ranck.
Report of the Work on Alfala at Holly Springs Branch Experiment Station, September, 1912—C. T. Ames.
Diseases Prevalent Among Horses and Cattle in Mississippi, July, 1913—E. M. Ranck.
Mississippi Poultry House, March, 1914—D. Scoates.
Growing Hogs in Mississippi, June, 1914—E. M. Ranck.
Express Cotton, January, 1915—E. C. Ewing.
Wheat Production in the Delta, October, 1917—G. B. Walker.
Corn Varieties Test at Delta Branch Station, 1913 to 1917, Inclusive, 1917—G. B. Walker.

(5) Mississippi Agricultural Experiment Station Entomological Press Circulars

1. The Boll Weevil Situation in Mississippi, July 1, 1911—R. W. Harned.
2. Danger of an Outbreak of the Cotton Worm in Mississippi, July 19, 1911—R. W. Harned.
3. How to Fight the Cotton Worm, July 31, 1911—R. W. Harned.
4. The Southern Grass or Southern Army Worm, May 25, 1912—R. W. Harned.
5. The Horn Fly on Cattle, May 31, 1912—R. W. Harned.
6. The Southern Buffalo Gnat, June 1, 1912—R. W. Harned.
7. The Melon Caterpillar, July 15, 1912—R. W. Harned.
8. How to Fight the Southern Grass Worm, July 17, 1912—R. W. Harned.
9. Be Prepared for the Cotton Worm, July 22, 1912—R. W. Harned.
10. The Cabbage Aphis, November 30, 1912—R. W. Harned.
11. The Chinch-bug in Mississippi, May 23, 1913—R. W. Harned.
12. Insects Affecting Melons, Cucumber, and Squash, July 1, 1913—R. W. Harned.
13. The Cotton Worm Situation, August 12, 1913—R. W. Harned.
14. Cotton Worm Situation, August 12, 1913—R. W. Harned.
15. How to Look for Boll Weevils, September 26, 1913—R. W. Harned.
16. Grasshopper Control, July 15, 1914—R. W. Harned.

17. Carbon Bisulphide, or "High Life", for Stored Corn and Peas, December 2, 1914—R. W. Harned.
18. Citrus Canker, December 30, 1914—R. W. Harned.
19. Spraying Peaches and Plums, March 16, 1915—R. W. Harned.
20. May Beetles and Pecan Trees, June 9, 1915—R. W. Harned.
21. Blister Beetles, June 9, 1915—R. W. Harned.
22. The Corn Stalk Beetle, June 19, 1915—R. W. Harned.
23. The Tomato Fruit Worm, June 21, 1915—R. W. Harned.
24. Ambrosia Beetles and Pecan Trees, July 1, 1917—R. W. Harned.
25. The Cotton Worm, August 2, 1917—R. W. Harned.
26. Turnip Louse, November, 1916—R. W. Harned.
27. Caterpillar Attacks Sweet Potato; Can Be Controlled, September 11, 1917—R. W. Harned.
28. How to Control Flea Beetles on Irish Potatoes, September 14, 1917—R. W. Harned.
29. The Sweet Potato Weevil in Mississippi, January 8, 1918—K. L. Cocherham.
30. Southern Plum, or Rusty Brown, Aphis Appears, May 4, 1918—R. W. Harned.
31. Fight the Sweet Potato Weevil at Harvest, August, 1918—R. W. Harned.
32. Suggestions for Planting Sweet Potatoes in Territory Infested with Sweet Potato Weevils, June 29, 1919—R. W. Harned.
33. The Periodical Cicada, or Thirteen-Year Locust, May 21, 1920—R. W. Harned.
34. More Facts About the Periodical Cicada, or Thirteen-Year Locust, June 9, 1920—R. W. Harned.
35. The Yellow-striped Army Worm, or Cotton-boll Cutworm, June 22, 1920—R. W. Harned.
36. The Southern Grassworm on Corn, July 12, 1920—R. N. Lobdell.
37. If You Are Going to Poison the Boll Weevil This Year, July 24, 1920—R. W. Harned.
38. Controlling the Peach Tree Borer, 1920—O. I. Snapp.
39. Formula for a Fly Repellant, 1919—L. A. Higgins.
40. The Periodical Cicada in Mississippi in 1922, June 15, 1922—R. W. Harned.
41. Blister Beetles, July 15, 1922—R. W. Harned.
42. The Tomato Fruit Worm, July 17, 1922—R. W. Harned.
43. The Chinch-bug in Mississippi, July 17, 1922—R. W. Harned.
44. Stop the Grasshoppers, July 17, 1922—R. W. Harned.

(6) Mississippi Agricultural Experiment Station Miscellaneous Press Circulars

Tests of Different Varieties of Cotton, 1911—J. R. Ricks.
Varieties of Corn Tested at Mississippi Experiment Station, 1911—J. R. Ricks.
Cotton Varieties for Mississippi, December, 1916—H. B. Brown.

(7) Mississippi Agricultural Experiment Station Posters and Newspaper Articles

In addition to the regular bulletins, circulars, and reports listed above, the Experiment Station sends out numerous posters and newspaper articles dealing with agricultural problems that need immediate attention.

(8) Mississippi Agricultural Experiment Station Annual Reports

First Annual Report, 1888—S. M. Tracy.
Second Annual Report, 1889—S. M. Tracy.
Third Annual Report, 1890—S. M. Tracy.
Fourth Annual Report, 1891—S. M. Tracy.
Fifth Annual Report, 1892—S. M. Tracy.
Sixth Annual Report, 1893—S. M. Tracy.
Seventh Annual Report, 1894—S. M. Tracy.
Eighth Annual Report, 1895—S. M. Tracy.
Ninth Annual Report, 1896—S. M. Tracy.
Tenth Annual Report, 1897—W. L. Hutchinson.
Eleventh Annual Report, 1898—W. L. Hutchinson.
Twelfth Annual Report, 1899—W. L. Hutchinson.
Thirteenth Annual Report, 1900—W. L. Hutchinson.
Fourteenth Annual Report, 1901—W. L. Hutchinson.
Fifteenth Annual Report, 1902—W. L. Hutchinson.
Sixteenth Annual Report, 1903—W. L. Hutchinson.
Seventeenth Annual Report, 1904—W. L. Hutchinson.
Eighteenth Annual Report, 1905—W. L. Hutchinson.
Nineteenth Annual Report, 1906—W. L. Hutchinson.
Twentieth Annual Report, 1907—W. L. Hutchinson.
Twenty-first Annual Report, 1908—W. L. Hutchinson.
Twenty-second Annual Report, 1909—W. L. Hutchinson.
Twenty-third Annual Report, 1910—J. W. Fox.
†Twenty-fourth Annual Report, 1911—J. W. Fox.
†Twenty-fifth Annual Report, 1912—E. R. Lloyd.
†Twenty-sixth Annual Report, 1913—E. R. Lloyd.
†Twenty-seventh Annual Report, 1914—E. R. Lloyd.
†Twenty-eighth Annual Report, 1915—E. R. Lloyd.
†Twenty-ninth Annual Report, 1916—E. R. Lloyd.
†Thirtieth Annual Report, 1917—E. R. Lloyd.
†Thirty-first Annual Report, 1918—E. R. Lloyd.
†Thirty-second Annual Report, 1919—J. R. Ricks.
†Thirty-third Annual Report, 1920—J. R. Ricks.
*Thirty-fourth Annual Report, 1921—J. R. Ricks.
*Thirty-fifth Annual Report, 1922—J. R. Ricks.

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†Not published as separate reports. Only included in the general college reports.

Mississippi Agricultural Experiment Station

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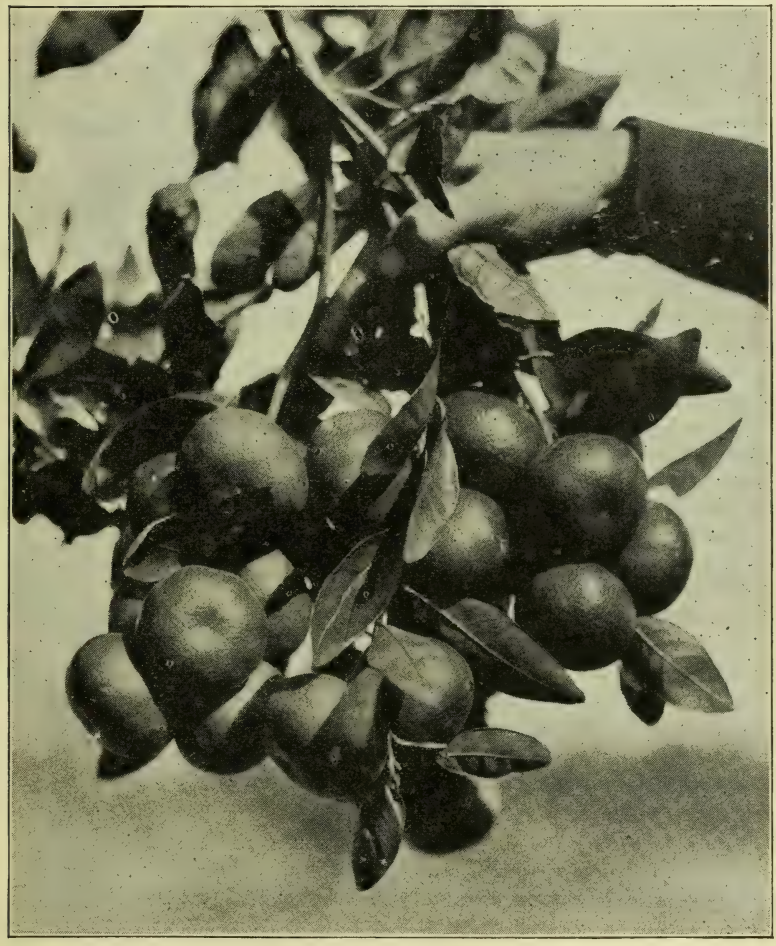
Bulletin No. 217 April, 1923

The Satsuma Orange in South Mississippi

By
E. B. Ferris and F. B. Richardson



Cluster of Oranges on a Satsuma Tree, Coastal Plain Experiment Station, McNeill, Mississippi

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

EXPERIMENT STATION STAFF

D. C. Hull, M. Sc. ..... President of College.
J. R. Ricks, M. Sc. ..... Director and Chief in Agronomy.
M. H. Moore ..... Secretary and Financial Agent.
E. B. Ferris, M. Sc. ..... Asst. Director, South Miss. Branch Station.
C. T. Ames, B. Sc. ..... Asst. Director, Holly Springs Branch Station.
C. B. Anders, B. Sc. ..... Asst. Director, Raymond Branch Station.
W. E. Ayres, M. Sc. ..... Assistant Director and Plant Breeder, Delta Branch Station.
S. W. Greene ..... In Charge of Coastal Plains Branch Station*.
W. F. Hand, M. Sc., Ph. D. ..... Chemist.
J. S. Moore, M. Sc. ..... Chief and Dairy Husbandry.
R. W. Harned, B. S. A. ..... Chief in Entomology.
C. F. Briscoe, A. M., Ph. D. ..... Bacteriologist.
E. Barnett, V. M. D. ..... Chief in Animal Husbandry.
J. M. Beal, M. Sc. ..... Botanist.
E. P. Clayton ..... Poultry Husbandman.
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D. C. Neal, B. Sc., M. A. ..... Plant Pathologist.
J. N. Lipscomb, M. Sc. ..... Farm Management.
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J. C. C. Price, B. Sc. ..... Horticulturist.
Earle Brintnall, B. Sc. ..... Dairyman.
C. J. Goodell, B. Sc. ..... Animal Husbandman.
K. U. Jones, B. Sc., V. M. D. ..... Veterinarian.
R. N. Lobdell, M. Sc. ..... Zoologist.
F. B. Richardson, B. Sc. ..... Horticulturist, South Miss. Branch Station.
H. F. Wallace, B. Sc. ..... Asst. at Holly Springs Branch Station.
I. P. Trotter, M. Sc. ..... Asst. at Delta Branch Station.
M. E. Andrews, M. S. A. ..... Associate in Farm Management.
H. H. Harned, M. S. ..... Associate in Bacteriology.
Rowland Cowart, M. Sc. ..... Assistant Agronomist.
Miss Kittie Sue Johnson, A. B. ..... Secretary-Stenographer.
Miss Mary Alice Lanier ..... Addressograph Operator.
Miss Fannie Page ..... Stenographer.
D. W. McIlwain ..... Superintendent of Farm.
D. Maxwell ..... Foreman and Herdsman.
B. V. Evans ..... Farm Foreman, South Miss. Branch Station.
J. C. Ryan ..... Farm Foreman, Holly Springs Branch Station.
L. P. Peyton ..... Farm Foreman, Raymond Branch Station.
K. C. Livingston ..... Farm Foreman, Delta Branch Station.
F. O. Cork, B. Sc. ..... Supt. Farm Management Vocational Project.
R. G. Reeves, B. Sc. ..... Fellow in Plant Breeding.
H. B. Brown, Ph. D. ..... Collaborator.
E. C. Ewing, M. Sc. ..... Collaborator.

*In Cooperation, Bureau of Animal Industry, U. S. Department of Agriculture.

Experiments With Citrus Fruits at McNeill, Mississippi 1908 to 1923

By E. B. FERRIS

Introduction. On October 12th, 1907, the writer pulled his first orange from a tree. This was a Satsuma and was grown in Pearl River County. Having been reared in a more northern latitude and at a time when the small boy seldom saw an orange except at Christmas, we had always associated a place where oranges grew as a sort of fairy land and the time with that happiest of all seasons—when Santa was expected, so this experience made a lasting impression. We had on more than one occasion visited the orange belt of Southern California, a fairy land in itself, but at a season when oranges were not ripe, and had seen the great potential value that the ability to grow Citrus fruit gave to any soil, so it was not hard, even as far back as 1907 to foresee the great possibilities for South Mississippi as a citrus section. The place where these Satsumas grew was the home of Mr. John J. Amacker, eight miles west of Poplarville and ten miles north of McNeill. These trees had been set out in 1901 and at the time referred to had been bearing since 1904, had never been given any protection from the cold, nor had they been seriously affected by any insect pest or plant disease. It may be well to say here that these two trees still stand in Mr. Amacker's yard and he tells us they have never failed to bear respectable crops every year, more often than otherwise having to be protected against breakage from too much fruit, and that with better attention in recent years the trees have taken on new life and are continuing to thrive.

As soon after this experience as possible there was set out on the station at McNeill a small number each of several kinds of citrus trees including Satsumas, Lemons and Citranges, the latter being a cross between the sweet and trifoliate (Citrus sinensis x Poncirus trifoliata) orange and much hardier than the former. From the experience of this planting of citranges we feel sure they will stand the climate at least as far north in Mississippi as the A. & V. Railroad and that the best of them might well be worth growing for home use.

Citranges. On January 8th, four varieties of Citranges, furnished by the United States Department of Agriculture, were set out at McNeill. These included three Colmans, four Savage, five Rustic, and three Morton. On the following 31st day of December all these trees were living except two and about this time an additional planting was made of six varieties of lemons of one tree each with an equal number of Satsuma trees. These plantings were made along an avenue extending from the road to the station buildings. No protection, except banking the lemons and Satsumas, was given any of these trees and one year from that time all the lemons were dead while all Satsumas and Citranges were alive and growing nicely. Continuous observations have since been made on the Citranges and up to 1923 all trees, except as noted above, are still living. Only one of the va-

rieties, the Morton S. P. I. 16872, would seem to have any practical value. The other three varieties bloom and bear freely but the fruit is not edible, is generally poorly shaped, often splitting open on the tree, while the trees themselves, except for the very fragrant blossoms, are not attractive. The Morton is very ornamental, large and shapely, blooming and bearing over long periods of the year and developing a fruit that is large and well shaped and which makes a delightful ade or with sugar a good substitute for the grape fruit. This Morton variety would be well worth growing for its ornamental features alone as it, too, has a very fragrant blossom. These trees are shown on the extreme left of the illustration in this bulletin.

View of Satsuma grove at Coastal Plain Experiment Station, McNeill, Miss., with Citrange Trees showing in the fore ground at the extreme left.

Work with Satsumas. On the strength of this success with these original plantings the succeeding legislature was asked for and gave $200 for additional work with oranges and in the fall of 1911 this money was spent in planting a little more than two acres of land largely to Satsumas. At that time the McNeill station was being operated on a very meager support fund with only one scientifically trained man, the director in charge, to plan and keep the records in every branch of station work which included dairying horticulture, agronomy and the keeping of office accounts. Therefore the experimental features of this work with oranges may not have been as comprehensive as they should, nor the data kept as complete as might be desired. Too, the years immediately following the setting of this orchard were not such as to lend help to an experiment that necessarily had to extend over a long period of time. These years were full of uncertainties for our particular station as well as for the branch stations of the state as a whole. At all times the legislatures disputed the right of the branch stations to live; there was seldom a session that did not debate a bill to abolish them;

and at one time the bills for the support of these stations was vetoed by the governor; while in the end the McNeill station had to choose between its removal to Poplarville or its probable abandonment entirely.

At the most critical time in the development of this orchard this change did take place and seemingly only by chance or the will of the Almighty were the authorities successful in getting a department of the Federal government to take over the old station ground and thus make possible the continuation of this work. Even when this was done it was taken over by the Bureau of Animal Industry, a department interested in an entirely different line of work, that of cattle, sheep and hogs and the growing of feeds for them. The Satsuma orchard might still have met an ignominious end had not the director in charge, Mr. S. W. Greene, have been a practical tree man before he became a scientific livestock man. As it was, it took time for him to become impressed with the possibilities of this fruit and to give them the protection against animals that were supposed to have first place with him. As a matter of fact, the orchard up to that time had never come into profitable bearing due to age and to two most unfavorable years and neither Mr. Greene nor the writer had come to so thoroughly appreciate the importance of this orchard as its subsequent behavior warranted.

At the time this work was started we knew little about the best methods of Satsuma production, fertilization, spacing, pruning, etc. and the methods of procedure with all these things were based largely on common sense rather than on precedent. The object of the work was largely to determine whether these oranges could or could not be profitably grown in South Mississippi, but as many experimental features as conditions would permit were injected into the work. An effort was made to determine if it were practical to grow the round oranges and grapt fruit and, if so, the best varieties of the same; the cheapest and best Satsuma trees for planting; while later it was intended to include work with fertilizers, spraying, and such other things as time might prove to be necessary.

The ground selected for this work was on the north west side of the place, on the top and side of one of the highest hills on the station enclosure, this hill sloping gently to the south. This land had been cleared in 1902 and a record had been kept of its history from the time of clearing to the time of setting to these oranges. In a soil survey made of the McNeill area in 1902 by the Bureau of Soils U. S. Department of Agriculture this particular land had been classified as Orangeburg Fine Sandy Loam, this being a sandy-loam surface soil underlaid by a sandy-clay subsoil of a deep red color. The land was prepared as for any other crop and laid off into squares twenty feet apart, the land being level enough to plow in any direction without serious erosion. The trees were furnished by the Glen St. Mary Nursery Company, Glen St. Mary, Fla., and were shipped from the nursery on Nov. 30th, but did not reach McNeill until December 15, were heeled out, and planted on December 21. They were promptly banked to protect them against cold and this practice was continued each winter thereafter, these banks being reinforced later when severe cold spells were imminent.

This main planting included twelve trees each of the following varie-

ties of round oranges: Ruby, Parson Brown, Carlton, Madame Vinous, Dugat and Grape Fruit. Also twelve trees each of the following sizes of Satsumas grafted in trifoliate stocks: 1 to 2 feet; 2 to 3 feet; 3 to 4 feet; 4 to 5 feet; 5 to 7 feet. The balance of the orchard was planted to 172 Satsumas 3 to 4 feet.

Early in the succeeding spring these trees were fertilized with a mixture of equal parts cottonseed meal and acid phosphate at the rate of one pound per tree, this being mixed with the soil with hoes as the mounds of dirt were pulled away from the trees. This application of fertilizers was continued each year and increased as the trees got older until they finally received several pounds per tree yer year. Various crops were grown between the trees such as Irish potatoes, cabbage, sweet potatoes, cowpeas and soy beans when the plan was finally adopted of growing soy beans every year, these being grazed off each year by hogs. When a non-legume was grown in the orchard these were fertilized with nitrogen and phosphorus and when a legume was grown it received phosphorus alone in the form of acid phosphate, usually at the rate of 300 pounds per acre.

Little pruning was done to the trees further than to keep dead limbs removed and occasionally to cut out branches that appeared too thick. The shape of the trees was never as symmetrical as with most other fruits, but in the absence of any better knowledge it was decided to let nature take its course.

At the end of the first year the following numbers of the twelve trees each of the several varieties had died: 7 of the Ruby; 8 of the Pineapple; all of the Parson Brown; 5 of the Carleton; 9 of the Grape Fruit; 6 of the Madame Vinous; and 10 of the Dugats. Also the following number of the several sizes of Satsumas: 7 of those 1 to 2 feet; 1 of those 2 to 3 feet; none of those 3 to 4 feet; 1 of those 4 to 5 feet; and 1 of those 5 to 7 feet. Of the 112 Satsumas 4 to 5 feet required to complete the orchard, thirty were dead at the end of the first year. The high mortality was attributed to the length of time required for the trees to reach their destination by freight and the nursery was good enough to furnish sufficient trees at half price to replace all that had died the first year and to ship these by express. The orchard was reset Nov. 30, 1912 with Satsumas 4 to 5 feet and the several original sizes and varieties were not replaced with their kind.

About such cultivation was given from year to year as was commonly practiced with other fruit trees. The crops grown between kept the middles worked while the tree rows were kept clean with cultivators and hoes. The practice of growing soy beans in rows between the trees and grazing these off in the fall with hogs proved the most satisfactory. While men and hogs have many habits and tastes in common, this does not extend to oranges, for the hogs never disturbed the fruit at all even though it hung on the trees in easy reach of their noses, while the best of wire fences, with notices to "Stay out, this fruit is poisoned" was not sufficient to keep men out of this orchard.

In 1913 a number of young oranges were found on the trees 5 to 7 feet as taken from the nursery row, but on no other tree in the orchard. In the fall of 1914 it was noted that a number of these trees had borne a

few oranges: The Satsumas 1 to 2 feet had no fruit; of those 2 to 3 feet, 4 trees had 12 oranges; of those 3 to 4 feet, 6 trees had 26 oranges; of those 4 to 5 feet, 2 trees had 2 oranges; and of those 5 to 7 feet, 5 trees had 25 oranges. The greatest number gathered from any one tree that year was ten oranges.

In September 1915 there came a severe gale which blew off a large part of the oranges and no attempt was made to keep records of the trees such as had been kept the year before, but it was noted that even with the number blown off there was a considerable increase over the number ripened the year before.

The round oranges had continued to die and in February of 1916 twelve Grape Fruit trees were set in the missing places of these round oranges. These were dead at the end of the year. In the fall of 1916 a fairly good crop of oranges was gathered notwithstanding the terrible July storm of that year which did so much damage to all crops of this section. About twenty-five half straps were sold this year at $1.50 each. The storm above referred to blew all limbs, leaves and bolls from cotton and all but blew the plants out of the ground, so much destruction was wrought that on our station we did not attempt to pick cotton that before the storm had promised a bale to the acre. More than twelve inches of rain fell in thirty-six hours during this storm and streams rose to unheard of proportions. It speaks wonders for the Satsumas that they survived this storm and the hard winter that followed it. In the fall of this same year the following observations were made with reference to the several varieties other than Satsumas: only one Ruby alive; 3 of the Pineapples alive and well fruited; all Parson Brown dead; 1 Carlton alive; all grape fruit dead; 4 Madame Vinous living and these well fruited; 4 Dugats alive, of fair size and well fruited.

In the fall of 1917 about thirty half straps were sold from the orchard at $1.50. We cannot pretend to say that the figures given represent even approximately the number of oranges borne by the trees. This orchard had a public highway on one side and private roads used by the general public on two other sides. Oranges were entirely new to the public and the impression all too common that what belongs to the state belongs to the individual was peculiarly abroad in that land so that a great many of these oranges stuck to hands that had no right to them.

The legislature of 1918 authorized the removal of the station from McNeill to Poplarville and all experimental work was discontinued at McNeill and started at Poplarville. After that year Mr. S. W. Greene of the Bureau of Animal Industry, U. S. Department of Agriculture took charge at McNeill and in 1918 and 1919 we have no records of yields of this orchard. In 1920 Mr. Greene numbered each tree, or the place of each tree, in the orchard and began keeping individual records of these trees. As in previous years it was found difficult to prevent pilfering, but these records show that in 1920, 2888 oranges were gathered from the orchard with 187 as the largest number from any one tree. In 1921, 5,403 oranges were gathered from the orchard with 228 as the largest number from any one tree. In

1922, 35662 oranges were gathered from the orchard with 1100 as the largest number from any one tree.

From the time of setting through 1922 this orchard was never systematically sprayed and only twice was it sprayed at all and that against the white fly with Schnarrs Insecticide. A peach orchard set out several years later on an adjoining plat of land had been sprayed regularly up to the time of our leaving McNeill and had borne two crops, in two years after this, without spraying had died completely from San Jose scale. This to show the comparative freedom of the Satsuma from insect pests and not as any argument against spraying, for doubtless the trees would have done much better if they had been sprayed, while now there are doubtless many newly introduced troubles that were not apparent ten years ago.

Notes made on this orchard early in 1923 showed that a large part of the round oranges had died and been replaced with Satsumas and of the few remaining all were sprouts from the trunk beneath the soil mound. There was one sprout from the Ruby; three from the Pineapple; none from the Parson Brown; five from the Carlton; four from the Madame Vinous; and four from the Dugat. There were thirty-eight missing trees in the orchard. No observations had been made regularly as to the difference in sizes of the several plantings of the Satsuma trees but as they stand in the row now the smallest original planting, those one to two feet as taken from the nursery row, were as large as the largest original planting, those five to seven feet. This would indicate that there is no use spending money for extra large stock. In the beginning the very small trees died badly the first year, possibly due to their having dried out worse in shipment or to the very cold winter that followed immediately after planting. However, the next size or those two to three feet as taken from the nursery row, lived and grew off as well as any other size used.

Our criticism of this orchard, based on what we have seen of other orchards, is that the trees have developed too little growth. This may have been caused by improper cultivation, to our having grown crops too long between the trees, or to a lack of proper kind and quantity of fertilizers. At any rate, no tree in the orchard compares in size with a few trees planted later on the Weston farm near Logtown. The trees at McNeill were all Satsumas on trifoliata stock while those near Logtown were Satsumas on rough lemon stocks. These last named trees are practically twice as large as the ones at McNeill and one of them bore 3800 fruits in 1921.

The work with these oranges clearly shows that the round oranges, grape fruit, and lemons are not sufficiently hardy to recommend for commercial plantings, though they are being grown for home use all over this section; the Citranges are exceptionally hardy and vigorous, but produce fruit of low quality; the Satsumas have been winter hardy, they produce satisfactory yields of fruit of high quality, and are increasing yearly in proportion to the amount of wood growth produced.

Put out as a minor project with no previous work in this section to serve as a guide in its management, this orchard has developed into one of the best paying crops on the station.

As soon as possible after the removal of the station from McNeill to Poplarville, appreciating the importance of fruits in general and oranges in particular to South Mississippi, our station employed a regular horticulturist and started new work with Satsumas. This work has not advanced to the stage where any experimental data has been accumulated, but the plan of the work has been well conceived by a man trained as a scientific horticulturist. This man is Mr. F. B. Richardson, who has made quite a study of Satsuma oranges in connection with this new work, has traveled widely over the orange belt interviewing the best growers of this fruit, and who, in this publication, has been asked to prepare the main body of the bulletin in which is discussed the Satsuma production from all angles, giving the best and most approved methods as determined by his own and the experience of a number of the best growers. The accompanying table gives a fairly complete record of maximum and minimum temperatures and rainfall as kept by us through 1918 at McNeill and since that time at Poplarville. It more than covers the life of the orchard at McNeill and practically covers the life of the two Satsuma trees as mentioned in the opening paragraph of this bulletin. Such a table should be invaluable in making a critical study of the possibilities of commercial Satsuma production in this section as a whole.

Year	January			Feb.			March			April			May			June			July			Aug.			Sept.			Oct.			Nov.			Dec.			Annual Rainfall
	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	Maximum	Minimum	Rainfall	
1903	....	....	.....	....	22	.....	....	....	16.0	86	41	.05	92	48	1.38	97	54	4.39	98	62	11.0	.....	66	8.0	96	50	1.65	91	36	.33	85	25	.59	78	24	.47	.....
1904	70	22	4.0	83	29	5.0	86	33	2.7	90	42	1.6	95	52	2.6	98	63	4.7	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....	....	.....	.....
1905	....	16	7.7	....	13	8.4	....	40	9.7	93	38	11.6	....	57	6.4	98	64	5.5	97	63	8.5	94	67	5.5	93	59	3.3	86	39	8.0	79	36	3.4	69	25	7.2	85.47
1906	75	25	3.5	70	29	4.5	79	28	10.6	....	39	2.0	94	45	3 0	99	64	5.5	95	68	5.8	100	68	3 8	95	65	10.2	85	38	.8	84	27	1.2	80	26	2.4	53.2
1907	80	28	1.2	78	30	6.3	90	41	1.2	85	30	7.0	91	49	10.9	95	54	2.7	98	68	6.1	97	66	10.5	96	60	6.0	90	38	1.3	81	28	6.6	74	27	6.7	66.5
1908	76	25	6.0	75	27	4.9	90	38	3.0	89	48	4.0	94	39	8.8	95	61	7.9	96	66	12.3	96	64	7.5	95	48	9.4	84	36	.5	82	30	1.2	80	28	1.2	66.6
1909	78	21	2.5	78	23	5 9	84	34	6.5	87	39	6.3	88	45	12.2	97	66	10.5	97	61	8.7	103	69	7.4	95	47	8.5	94	39	3.7	84	31	1.0	75	20	7.9	81.2
1910	74	22	2.8	75	23	5.1	88	30	1.0	87	36	.4	94	57	4.6	94	60	10.1	96	66	10.8	97	30	3 1	96	56	3.1	96	30	4.2	82	32	1.9	72	23	2.1	49.1
1911	81	15	4.2	80	25	2.3	90	37	5.5	85	47	11.1	98	53	2.9	99	67	6.0	93	62	8.9	97	68	6.6	98	68	8.1	93	39	4.2	81	23	3.4	74	26	6.1	69.27
1912	72	19	5.6	74	23	4.1	85	47	11.1	98	53	2.9	96	50	10 5	93	63	3.6	98	67	6.8	94	65	10.2	96	65	2.9	90	42	1.4	80	30	1.5	74	29	9.7	83.4
1913	83	31	7.8	74	27	5.3	82	30	8.9	90	39	5.1	94	50	7.5	100	56	2.9	98	67	8.9	97	65	4.0	95	47	8 9	86	34	2.5	79	30	2.3	78	30	2.5	66.6
1914	77	27	1.3	79	24	6.0	80	30	6.1	87	50	8.7	91	49	2.9	100	68	6.1	96	69	6.4	94	68	7.2	94	54	5.9	88	42	1.7	83	26	6 4	71	23	5.0	63.5
1915	71	26	7.8	73	32	6.8	76	28	1.9	91	33	.1	97	55	4.2	101	64	3.0	100	65	7 5	98	62	8.9	98	58	9.5	88	35	1.5	83	25	1.4	76	30	4.6	63.0
1916	70	25	5.3	77	21	2.7	83	30	2.5	81	37	7.0	97	54	5.8	96	55	3.0	93	67	21.8	95	63	4.8	94	47	3.4	90	36	3.0	83	25	1.4	78	25	4.4	65.1
1917	79	27	8.0	82	19	7.2	83	24	6.9	86	38	2.9	92	45	.7	98	55	1.4	96	67	6.33	96	....	3.16	.....	....	4.01	91	....	.22	77	....	1.15	....	....	3.0	45.67
1918	73	14	5.72	....	....	2.28	85	45	1.85	86	36	6.97	91	50	2.27	99	67	3.63	99	63	6.27	100	58	3.10	96	46	1.25	93	45	10.63	86	36	3.91	80	23	9.37	57.65
1919	73	14	8.45	75	29	6.75	85	45	5.56	89	35	9.0	90	48	11.34	96	61	4.22	.....	....	.....	98	60	4.74	93	55	.74	95	55	6.76	82	....	7.57	80	23	4.87	69.0
1920	81	21	4.52	78	26	5.33	84	23	2.96	89	35	6.15	96	51	3 87	98	60	4.62	97	66	8 17	99	65	4.61	.....	46	4.03	....	....	.....	89	29	4.04	74	26	9.27	57.57
1921	....	....	4.02	80	32	2.78	89	39	6.05	88	37	5.58	98	41	2.91	98	65	4.14	102	66	4.66	.....	67	7.26	102	68	5.07	92	42	2.50	87	39	3.56	81	31	5.64	56.07
1922	77	28	6.29	85	28	5.20	83	27	9.52	89	45	3.83	93	53	7.31	102	64	3.00	97	63	7.24	97	61	3.04	99	62	1.79	90	43	2.83	90	35	3.14	84	35	8.78	58.83
1923	78	32	4.27	81	23	4 48	85	27	5.12	....	....	.....	....	....	.....	....	....	.....	....	....	.....	....	....	.....	....	....	.....	....	....	.....	....	....	.....	....	....	.....	.....
Avg.	76	23	5.0	77	25	6.6	84	33	5.9	92	39	5.2	93	49	5.5	97	61	4.8	79	65	8.6	97	62	5.1	95	55	5.6	90	39	3.3	83	29	2.9	72	26	5.3	

The Satsuma Orange in South Mississippi

GROVE MANAGEMENT AND REQUIREMENTS FOR COMMERCIAL PRODUCTION

By F. B. RICHARDSON, Horticulturist

Introductory. The Satsuma Orange is a native to China and Japan, indications being that it first originated in Japan, where there are bearing trees more than 300 years old. It was first introduced into the United States in the Gulf Coast section of Mississippi about 1895. The industry has grown until there are possibly more than 20,000 acres of this citrus fruit, with the bulk of the plantings in Mobile and Baldwin Counties, Alabama. With the opening of suitable land in South Mississippi, the Satsuma Orange has gained rapidly in this State, and numerous inquiries from prospective planters regarding it make a publication on the subject imperative.

The Satsuma groves in this State are located mainly in Harrison, Jackson, Pearl River, Stone, Hancock and George Counties, at or near the following places: Ocean Springs, Biloxi, Gulfport, Long Beach, Pass Christian, Bay St. Louis, Carriere, McNeill, Poplarville, Lumberton, Lyman, Wortham, McHenry, Wiggins, Fruitland Park, Lucedale. There are other scattered plantings in the six counties named, but the chief locations are those given. The largest commercial grove of bearing age at present is on the Swan Company property, two miles east of Lyman. This is a 6500 tree planting which has been given first class attention, and which made an exceptional yield in its fourth season, in 1922. At Carriere a large com-

Satsuma Grove, Lyman, Miss. Fourth year from cut-over land

mercial development is in progress. Near McNeill, 1000 acres have recently been purchased for the purpose of planting exclusively to the Satsuma. An extensive commercial development is under way at Hovey. The J. J. Scarborough twelve-year grove at Poplarville has been very successful, the same being true of more recent plantings at Lumberton. Probably the largest combined acreage of bearing trees in any one vicinity is near Wiggins, there being a total of at least 150 acres. The experience gained from these older plantings, where under correct practices wonderful yields have been secured, has given much encouragement for greatly increased acreage. It is the purpose of this publication to point out the requirements of success as far as they have been determined. Experiment Station data on the subject is quite limited, so that it has been necessary to get much of the data presented herewith from various reliable sources, credit for which is fully acknowledged.

The Satsuma Orange belongs to the Mandarin group, of which the China Mandarin and Dancy Tangerine are also varieties. The Satsuma is superior to any of its group for this section; the shipping qualities are good, it is ready for the market ahead of oranges from competing sections, and has become very popular in the few consuming markets to which it has been shipped. It is very high in per cent of juice, while the distinctive blending of citric acid and sugar content give it a delightful and highly refreshing quality. In addition, it is practically seedless. The Satsuma and other varieties of the Mandarin group are sometimes called "Kid Glove Oranges" from the fact that the peeling can be removed so easily, and the sections separated, without squirting juice on the hands and clothes. It is primarily a high class dessert fruit and is destined to become one of the leading, if not the most important citrus fruit on the market.

Selection of a Locality and Site for a Grove

In the last analysis the exact location of the grove site is the deciding factor in establishing a commercial grove. Considering the general locality the prospective grove investor would be interested in a favorable climate as to healthfulness; good water; schools and churches; good transportation facilities; and the general freedom of the region from frost injury. If the general locality and the particular orchard site are both favorable, conditions are of course ideal.

With reference to the climate prevailing in these six counties, the following is quoted from a Bulletin by the U. S. Bureau of Soils: " * * * extremes of both summer and winter being tempered by proximity to the Gulf of Mexico. This is especially noticed in the summer, when winds from the south are delightfully cool. The summers are long, but not oppressively warm. The winters are mild and the few cold spells are always of very short duration." (From Bulletin of Soil Survey of Pearl River County, Miss.)

The question is often asked, "How far up from the Gulf Coast can the Satsuma be safely grown on a commercial scale?" The definite northern limit cannot be given with certainty. The districts where this citrus fruit has been grown for a number of years is the only basis on which to judge. The late G. A. Swan, one of the successful pioneers in Satsuma culture,

states that "Satsuma trees will stand when absolutely healthy and perfectly dormant, a temperature of from 12 to 14 without injury." In the Mississippi districts mentioned, the apparent limiting factors to successful commercial culture have been proper grove site, with good management in cultivation, fertilizing, and spraying.

The grove site should certainly have good air drainage, which is natural to uplands unprotected by windbreaks. Windbreaks of trees surrounding table lands, or at the bottom of slopes, prevent air circulation, and should be partially, if not totally removed. If a site is chosen with respect to good air drainage, proper soil drainage usually follows. Certainly the Satsuma grove should not be planted on wet lands. Close proximity to the Gulf would not be a deciding factor in the selection of grove site, as denoted by a number of successful groves several miles removed from the Coast.

Grove sites with an elevation of twenty-five feet or more above the surrounding country should be very desirable. In this connection, the variation in temperature at the base of a hill in mountainous country, and at different heights above, on a clear, still night is discussed in detail in Farmers Bulletin 1096. At the base of the hill, the lowest temperature during the night was 25 degrees; 25 feet above on the hillside, minimum was 30 degrees, and 50 feet up, 44 degrees. In addition, the 25 temperature lasted three hours, while the 30 degrees held for only a few minutes. At the base it was below freezing a total of 11 hours, while 25 feet above the temperature was barely below 32 a total of six hours.

As to soil requirements for the grove site, it may be said that in general most of the soil in the Satsuma belt which is suited to agricultural crops is satisfactory for Satsuma culture. Some growers claim that too light a soil is liable to start the trees into growth too early in the spring, though there is no experimental data regarding Satsumas to support this statement. The subsoil should certainly be substantial enough to be retentive of fertilizers, and there is an abundance of soil of this character.

To summarize the requirements for a desirable grove site, good air drainage is especially important, combined with satisfactory soil drainage and a good agricultural soil which is retentive of fertilizers. If the requirements for a good grove site can be combined with a locality having good schools and churches, transportation facilities, abundant supply of good water and favorable climate, the opportunity for success is highly favorable.

Preparation of Land for Planting. If cut-over land is purchased the first work involved is removal of stumps. The method most commonly employed at present is burning. A good method observed recently was to dig a hole two to three feet deep on an angle at one side of the tap root, and a second hole at an angle from the other side until it met the first one. This gives a V-shaped opening down by the side of the stump, with the bottom point of the V in contact with the tap root. Fire is started in the hole on the windward side of the V and the other hole acts as a flue, producing a good draft. The tap root is burned through after which the remainder of the stump can be dragged out and used to kindle the next stump. Bulletin 159 of the Mississippi Agricultural Experiment Station "Clearing Pine Lands," describes several methods in detail.

After clearing the land of the stumps, all slopes and rolling lands should be terraced to maintain the original fertility and to arrest soil erosion. The terraces and their outlet ditches may effect tree location, thus their construction should precede planting. Following this, the land should be plowed six to eight inches deep, a tractor with disc plows being especially suitable for the work. After plowing, disc the land thoroughly until the soil is well pulverized and settled. If the preparation of the soil is done thoroughly, there is no good apparent reason why the trees should not be planted the first year on new land, without waiting to crop the land one season. Unless all rotten wood has been thoroughly destroyed, there is danger from wood lice.

Selection of Satsuma Varieties for Planting. Commercial citrus fruit culture in this section should be confined at present to the Satsuma Orange. It will have to be admitted that preliminary tests at Lyman with round oranges, which include some of the best Mediterranean varieties, have been very encouraging; the trees have borne heavy crops of high quality fruit, which ripens earlier than the same varieties in competing sections. Grape fruit has also done well, though it is not advised with the present limited information available to make commercial plantings of either the round orange or the grape fruit. From an economical standpoint also, by concentrating all efforts on the Satsuma, markets will be more easily established and retained.

There have been three varieties of Satsumas grown in the Gulf Coast section: Owari, Ikeda, and Zairai. Plantings are devoted now to the Owari and Ikeda only. Ikeda is nearly spherical in shape, while the Owari is flattened, with a depression at both the stem and blossom ends. Owari is two to three weeks earlier than Ikeda and of better quality. There is considerable difference of opinion as to trueness to type of these two varieties, and it is possible that only through careful bud selection will true strains be developed and maintained.

The United States Department of Agriculture is testing out other varieties in addition to those mentioned above, among which Wase appears very promising.

As to the size of nursery stock for planting it is not considered advisable to plant anything larger than two to three foot trees. An orchard was planted in Poplarville in the spring of 1921 with two to three foot size Satsuma trees, and a four to five foot size. At this date there is no practical difference in the size of the trees which have been given identical treatment. The initial cost of the small trees is less, and in addition there is less expense involved in transportation charges and planting.

Setting the Trees. While many growers set the trees in December and January, February is likely the most ideal time. In February the weather is usually more favorable, and the trees are ready to start into growth by the first of March or soon thereafter. Set the trees in squares twenty-five feet apart, which will require seventy to the acre. Set the trees to such a depth so that when the soil settles the tree will stand at practically the same depth which it did in the nursery row. It is doubtful practice to

plant the tree deeper than it stood in the nursery row. If the Satsuma should develop susceptibly to foot rot, deep planting so that the bud union is below the surface of the ground would cause trouble. The Citrus Trifoliata stock on which the Satsuma is budded is practically immune to foot rot.

GROVE MANAGEMENT

Cultivation. Continuous clean cultivation should be given the orange grove from early spring until October, the object being to carry the trees through to winter in a thrifty condition. Cultivation need not be any deeper than necessary to maintain a good soil mulch for the conservation of moisture. The double disc harrow with extensions and shields adapted to orchard work, and drawn by a tractor, is a good combination to use in groves large enough to justify power equipment. Unless the winter cover crops have made an extremely heavy growth, the double disc harrow will work it into the soil without the help of a plow. For a horse drawn cultivator, the spring tooth harrow will do satisfactory work. The number of cultivations will be determined by the frequency of rains in the locality; the object should be to maintain a good soil mulch throughout the entire season.

Cover Crops. The soils throughout the Satsuma Orange belt are greatly improved by the use of cover crops or animal manures. Since manures are difficult to obtain in sufficient quantity, cover crops are used extensively to increase the humus content of the soil. A cover crop is grown primarily for the benefit of the trees and the hay from the crop should not be removed, but should be worked back into the soil. Cow peas or soy beans are ideal cover crops for this section. Plant in rows which can be cultivated until the cover crop takes the ground. In a young orange grove retain a six to eight foot space for each tree row, which should receive clean cultivation through September. The cover crop may be planted in the latter part of June, or through July. As soon as the cover crop is harvested in groves of bearing age, or in October or November for young orchards, plant a winter crop of oats or rye plowing under the following spring. Under no circumstances should the oats or rye be allowed to mature.

Intercrops. Unless land is very limited intercrops are not advisable. They interfere with the work of cross cultivation with the larger implements such as the disc harrow, thereby increasing the amount of hoeing to be done about the young trees. In the case of small groves, however, and where cash crops are desired from the spaces between the tree rows, several truck crops may be used to advantage during the first two years: tomatoes, peppers, radishes, beets, carrots or beans being good ones to use.

Fertilizers for Satsuma Oranges. For young trees during the first three years in the grove, use a 6:4:4 fertilizer mixture. Apply the following amounts **twice per year**, at the first of February, and first of July:

First year, 1 pound.
Second year, 1¾ pounds.
Third year, 2¼ pounds.

For bearing trees, from the fourth season on, use an 8:4:6 fertilizer mixture. Apply the following amounts twice per year, at the first of February, and again at the first of July:

Fourth year, 3 pounds.
Fifth year, 4 pounds.
Sixth year, 5 pounds.
Seventh year, 7 pounds.
Eighth year, 10 pounds.

After eighth year, apply amounts in proportion to age, condition, and crop present.

Materials and amounts for home mixture—The above figures apply to a standard fertilizer mixture, such as is made in fertilizer factories, to give a definite percentage of the fertilizer elements per ton of fertilizer mixture. If it is desired to mix the fertilizers at the grove, the following is recommended:

For the 6:4:4 mixture for young trees, use 300 pounds acid phosphate, 213 pounds Nitrate of Soda, 64 pounds Sulphate or Muriate of Potash. This will give a more concentrated mixture than a standard 6:4:4, and accordingly less weights per tree are required. Use as follows:

First year, ¾ pound per tree.
Second year, 1¼ pounds per tree.
Third year, 1¾ pounds per tree.

These weights to be applied twice per year same as above. The 6:4:4 formula for home mixing may be roughly approximated as follows: 3 100-lb. sacks Acid Phosphate, one 200-lb. sack Nitrate of Soda, two-thirds of a 100-lb. sack Sulphate or Muriate of Potash. This will mix up enough for 750 first year trees, one application. For 75 trees, one application in the first year, 1-10 of these amounts would be used, for example, 30 lbs. acid phosphate, 21 pounds nitrate of soda, 6½ pounds Sulphate or Muriate of Potash. For the 8:4:6 home mixture for bearing trees, mix up 600 pounds acid phosphate, 300 pounds nitrate of soda, 144 pounds Sulphate of Potash. Use this form of potash only for the bearing trees. Use following weights per tree twice a year:

Fourth year, 2½ pounds.
Fifth year, 3½ pounds.
Sixth year, 4 pounds.
Seventh year, 5 pounds.
Eighth year, 7½ pounds.

Distributing the fertilizer: If the home mixture is used, it may be prepared in the bed of a wagon, and hauled directly to the grove. Mix the material thoroughly, being careful to break up all lumps.

In order to get a measured amount of the fertilizer to each tree, use a can or bucket cut down to the desired capacity. While it is not expected that the precise weights indicated per tree should be used, still the weights applied should be reasonably close to those given in the table.

The fertilizer may be scattered in a trench four inches deep around the young trees, or it may be broadcasted close to the tree. For the first year

trees, the trench should be one foot away from the trunk; second year, 2 feet; third year, 5 feet. Thereafter up to the time of broadcasting the fertilizer in the middle, make the trench at about the droop of the outer branches, at which place the feeding roots are most abundant. Another method for applying the fertilizer to young groves is to plow a furrow on four sides of the trees at the desired distance from each, and scatter the fertilizer in these square trenches made around each tree. Cover back with the plow. If it is desired to broadcast the fertilizer to the young trees, apply at the distance from the trunk indicated above. Work the fertilizer into the soil immediately to prevent washing away by rains.

The second application of fertilizer given early in July is often varied to suit the conditions. It may be that the tree will require more or less than the amount indicated for the second application. Let the condition of the tree guide the amount of application.

These fertilizer formulas and instructions are based on recommendations used by the Harrison County Citrus Growers Association, (Branch of Gulf Coast Citrus Exchange). The Gulf Coast Citrus Exchange mixes its own fertilizers which are sold at cost to members of the Exchange.

Injurious effects of fertilizers. Excessive applications of fertilizers have been found to be injurious under Florida conditions. (1). The amounts given in the above schedule, however, are standard. Applications of lime have also proved harmful to the growth of the tree, causing a stunting, and frenching of the foliage. The excessive use of barnyard manures tends to produce a thick-skinned, puffy fruit of inferior quality. Excessive applications of Nitrate of Soda are claimed by one Louisiana grower to have caused the fruit to ripen two to four weeks later than properly fertilized trees of the same variety. Too much nitrogen will also cause the tree to make a sappy growth late in the season, subjecting the entire tree to frost injury. Kainit and Muriate of Potash are undesirable sources of Potash. The muriate may be used on young trees without any apparent ill effects.

Sulphate of Ammonia may be used in the home fertilizer mixtures instead of the nitrate of soda. The weights given in the schedule, however, do not apply when sulphate of ammonia is used, and it would be necessary to change the applications to give results equivalent to the nitrate of soda.

Control of Insects and Diseases. Spraying is an essential part of profitable citrus fruit production. In California, fumigation in addition is necessary, and is a costly process. Fumigation has never become necessary in this section and likely never will, judging from the success attained by consistent spraying both here and in Florida.

The most important pests of the Satsuma are the White Fly, Chaff Scale, Purple Scale, Florida Red Scale, Rust Mite, Red Spider. There are several of minor importance, but the spray materials used in the control of those named have proven to be effective for the ones of lesser importance. The caterpillar of the Orange Dog Butterfly may cause some damage to young trees by partial or complete defoliation, though with reasonable at-

(1) Bulletin 154 Fla. Agr. Experiment Station, "Citrus Fertilizer Experiments," by S. E. Collison.

tention by the grower, this insect is easily kept under control. The caterpillars are usually scattered over only a small per cent of the trees, so that hand picking is a practical means of control.

In common with all cultivated fruits, the Satsuma Orange is also subject to certain diseases which must be kept under control for best results. Citrus canker and citrus scab are of main importance at present. Citrus canker has been practically eliminated by the active work of the various State Plant Boards and U. S. Bureau of Plant Industry, while citrus scab can be effectively controlled by timely applications of Bordeaux Mixture sprays.

Many of the citrus troubles common to the older citrus sections are apparently not of much consequence to the Satsuma. By following standard cultural practices, the Satsuma grower should continue to enjoy this freedom from pests common to the older districts. New plantings should certainly reap the benefit of the pioneer experience accumulated in other sections.

Close attention should be given to new plantings the first season. Watch for white fly and purple scales especially. Citrus scab often appears at the start of the second season. As soon as any trouble develops start a vigorous campaign for its control. Do not wait until the tree has become weak and stunted by attack of insects and diseases.

In spraying for disease, prevention should be the object, rather than cure. Precede the entrance of the disease to the tree or fruit by timely applications of fungicide. In case the disease has already gained foothold, spray to prevent its further spread. After scab has once gained entrance to the tender fruit or leaves, no amount of spraying will cure the trouble on the diseased parts, and spraying should then be done to prevent further spread of the infection. For insect control the use of insecticide sprays before any insects appear would of course be useless. However, the orange grower may reasonably expect some insects or diseases the first year of two, and accordingly should make advance preparations for their control. While the Satsuma Orange tree has been able to stand more neglect than the peach in this section, from a commercial standpoint such neglect would mean failure. Even growers of Satsumas for home use should give the best of treatment to this fruit; home orchards should not be allowed to continue as breeding places for disease and insects.

Various ornamentals harbor the citrus white fly, one of the worst pests on the Satsuma. Plantings of the following ornamentals should be discontinued: Chinaberry trees; Gardenia (Cape Jessamine); Privets. These should certainly not be planted about homes where orange trees are desired. Hedges of Amoor River Privet swarm with white fly during the summer months and are difficult to spray thoroughly to eliminate this pest.

Spray Outfits. For the first three or four years of the orange grove the best makes of hand power outfits will do very satisfactory work at a minimum of expense in investment and upkeep. The following is recommended for a complete outfit: Double action hand pump (for mounting on platform outside of barrel or tank); equipped with double discharge pipe with cut-off for each; suction hose with strainer; presser gauge; agitator arrangement; two 35 foot leads of best grade spray hose ½-inch size, with

couplings; two 6-foot bamboo spray rods, aluminum or brass pipes, with shut-offs; single angle nozzle for each rod; tank, 100 gallon capacity preferred. A brass funnel strainer should also be included in the equipment.

A high grade hand outfit such as described will cost less than the lowest price gas engine power outfits and will give fine satisfaction while the trees are small. It is kept in good condition very easily, with few repairs needed. 125 to 150 pounds pressure can be maintained with two nozzles. Use a disc in the nozzle which will furnish a good spray fog at the highest pressure that can be maintained. The pressure should not be less than 125 pounds. As soon as more pump capacity is a necessity, purchase a reputable high-pressure outfit which will deliver ten to twelve gallons per minute at 250 to 300 pounds pressure. An outfit of this type will operate four leads of hose.

A convenient water supply will save valuable time. Records kept here at the Station showed that one-third of the total time, one-half hour, was spent in refilling a 50 gallon barrel outfit during spraying operations. The recent installation of a 500 gallon tower tank in the orchard, equipped with float valve and two inch discharge pipe and hose, delivers approximately 100 gallons per minuts and reduces the total time for refilling to about five minutes.

SPRAY SCHEDULE FOR SATSUMA ORANGES IN MISSISSIPPI

Also Applicable to Other Citrus Fruits

The extent of infestation and infection of insects and diseases should at all times govern the kind and frequency of spray applications. It is manifestly impossible to prescribe one set of treatments which would be equally applicable to each and every citrus planting, and because of this, no spray schedule should be followed slavishly. It is obviously poor management to spray for insect pests as indicated on the spray schedule when such insects are not present, and therefore the grower should thoroughly familiarize himself with the common insect pests and diseases of the Satsuma tree and fruit, so that the spraying operations may be done efficiently and economically.

SPRAY SCHEDULE

Late dormant spray for Citrus-Scab, Scale Insects, White Fly, Red Spider: Use Bordeaux mixture 3:3:50, plus one gallon oil emulsion in each 50 gallons of mixture. To be applied just before growth starts in the spring. Keep the diluted Bordeaux mixture agitated thoroughly, while adding the oil emulsion. The resulting mixture should total 50 gallons. The oil emulsion referred to here and in the following paragraphs refers to Yother's Government Formula. Directions for preparing spray materials given below.

If weather conditions are so unfavorable that this application is delayed until growth is already starting, reduce the amount of oil emulsion to 3 quarts.

The oil in this mixture kills all red spiders hit by the spray. Since only a small percent of them would be hit by careless or ignorant workmen, it should be emphasized that a thorough job is essential at all times to effectively control insects, pests, and diseases. Too much stress can not be put

on the fact that it is absolutely necessary to cover every portion of the tree, including the trunk, limbs, twigs, and both the tops and under sides of the leaves. Practically 99% of the white fly larvae and pupae, and red spiders are on the under sides of the leaves. It is likewise essential to hit the under sides of the leaves to cover the old Citrus-Scab lesions, to prevent early spread of scab infections.

Second Spray for Scab: Use Bordeaux mixture 3:3:50 plus three pints of oil emulsion in each 50 gallons of mixture. To be applied after most of the blossom petals have fallen. The oil in this mixture acts as a spreader, increasing the efficiency of the Bordeaux; 1 pound fish-oil soap may be used instead of the oil emulsion. This is the important spray for protection of the young fruits from early scab infection, and they should be coated thoroughly with the Bordeaux. However, it is not necessary to drench the fruit and leaves.

Another scab spray two weeks afterward may be necessary if the weather has been favorable to growth of the scab fungus. Rainy or foggy weather favors scab.

Lime-Sulphur solution, 32 deg. Baume', 1:40, is not more than 50% effective against severe scab infection. (†).

Rust Mites and Red Spiders:

Use Lime-Sulphur solution, (32 degrees Baume), strength 1 gallon in 50. Rust mites and red spiders are most numerous in dry weather. In some years they are not numerous enough to be noticeable. The presence of these pests is the only guide as to time of application of Lime-Sulpher spray. In this locality, in favorable seasons, the first spraying will likely be necessary in June. Red spiders are usually very numerous during the mild winters on the Coast, and can be controlled by the oil sprays recommended in the following paragraph.

Dormant Season Sprays: One or two fall and winter applications of oil emulsion, one gallon in 50, may be necessary to clean up infestations of scale insects, white flies, and red spiders. On severe infestations of purple scale, the writer has used 1½ to 3 gallons of oil emulsion in 50, with effective scale control, and no apparent foliage injury. These strengths were used during the dormant period only, and due to extra heavy incrustations of scale, the extra strength used seemed justified. However, neither of the greater strengths has been tested sufficiently to advise its general use.

These dormant season sprays may be applied after November 1st, or after harvesting in the case of bearing trees, up to February first.

During July and August, watch for scale insects and white flies. Use oil emulsion, 3 quarts in 50 gallons for their control. When thoroughly applied, this spray should also be effective against rust mites. This spray is not a control for the adult stage of the white fly. Note the date when most of the adult flies have disappeared, wait two weeks and then spray. This will catch the flies in the larvae stage, when they are most easily killed.

(†) "Citrus Scab: Its cause and Control," by John R. Winston, Pathologist, U. S. D. A. Bulletin No. 1118.

In years of average disease or insect infections and infestations, the applications necessary, in their seasonal order, would be about as follows:

1. Late dormant spray for scab, scales, white fly, red spider.
2. Scab spray after most of the blossoms petals have fallen.
3. Application for rust mites and red spiders in June.
4. Oil spray latter part of August for scales, white fly, rust mites.

Nos. 1, 2 and 4 may be considered essential each year. No. 3 will be determined largely by seasonal conditions.

Preparation of boiled oil emulsion. Government formula. From Farmers Bulletin 933:

"Formula:

Paraffin Oil, 2 gallons;
Water, 1 gallon;
Potash fishoil soap 2 pounds, or one pound of hard soap.
Hard soap not so satisfactory; emulsion made from hard soap should be used the day it is made.

Directions: Put oil, water, and soap into a kettle or other vessel that will stand fire, and heat to the boiling point. While still very hot, pump the material into another vessel and then back again. Emulsion cannot be made by this formula without a pump; stirring is not sufficient."

A pressure pump is necessary for this work. Stirring with a paddle will not do. On the other hand, excessive pumping will break up a good emulsion.

Test Spray Material: Before mixing up the emulsion for spraying, it should be tested to see if it makes a perfect emulsion with the water. Test by adding a small amount of the emulsion to some soft water. If it mixes immediately, forming a milky-white solution with no grease or scum forming on top it will be satisfactory. If oil comes to the top it should not be used. Recooking with the addition of a little more soap will usually correct the condition.

It sometimes happens that deep well water or sulphur water is the only kind to be obtained for spraying. Under these conditions a weak solution of Bordeaux mixture: ½:½:50, should be added to the water previous to the addition of emulsion, in order to obtain a stable mixture.

Any heavy grade of lubricating oil testing 24 to 28° Baume' will make a good emulsion.

Preparation of Bordeaux mixture, 3:3:50. In Bordeaux mixture formulas, the first figure refers to the number of pounds of Copper Sulphate (Blue Stone); the second figure is the number of pounds of fresh stone lime, and the third figure is the amount of total mixture resulting from addition of water.

Dissolve 3 pounds of Copper sulphate in a wooden bucket; slack 3 pounds of stone lime in another bucket. Pour these simultaneously into 30 gallons of water in the spray barrel. Maintain vigorous agitation in the spray barrel or tank while adding the stock solutions. Add water to bring the total up to 50 gallons. Bordeaux mixture should be agitated thoroughly while spraying.

For filling a 200-gallon tank, four times the amounts given for 50 gallons would be necessary, and the copper sulphate and lime should be mixed separately in wooden tubs. Do not use iron or galvanized iron vessels for mixing Bordeaux. Two wooden tubs made by sawing a 50-gallon barrel in two, will be convenient for this mixing.

A high grade of fresh stone lime should be used. Air-slacked lime should never be used.

Bordeaux mixture should be used on the same day it is prepared.

Several commercial Bordeaux preparations are on the market. They are made in powdered and paste forms. The labels give the amounts to use. They

The heavy fruiting tendency of the young Satsuma tree. Extreme upright branches have been produced in this tree by the method of pruning. See discussion.

are easily mixed, and when used in strengths equivalent to the home made Bordeaux, should give just as good results. Where large quantities of Bordeaux are used, with time saving equipment such as convenient loading platform and mixing vats, it would doubtless be more economical to use the home-made mixture.

Pruning: Up to this time, very little pruning has been practiced on the Satsuma tree. This neglect is due in part at least to the fact that the industry is new, with little definite information on the subject; and to the fact that in the past, the trees have borne large crops under adverse conditions, causing the grower to be more or less self-satisfied. With the rapid expansion of commercial plantings, however, strict requirements for profitable production of high grade fruit has demanded an improvement in all cultural methods. Even yet, there has not been found necessary any elaborate system of pruning such as followed for most fruits, and while the present requirements for the pruning work are quite simple, still they are essential to the best success. The pruning operations may be divided roughly into three parts:

(1) Shaping the tree.
(2) Removal of dead, diseased, and broken branches.
(3) Removal of suckers from the stocks.

(1) Shaping the tree. A low head is most desirable, with the main branches starting six to twelve inches from the ground. Three to five main branches are sufficient. As these branches have a distinct tendency in two or three years to droop to the ground, when loaded with fruit part of the crop is damaged for commercial use by coming in contact with the soil. Also, in extreme cases, under heavy loads of fruit the main branches may split from the trunk. These troubles may be averted, not by high heading of the tree, but by pinching or clipping off the ends of the drooping branches, to stimulate the growth of a number of upright shoots on the main branches. An "open head," such as recommended for the peach, is not desirable for the Satsuma, though crossing branches which are obviously injurious because of rubbing, shuold be removed. Some of the highest quality fruit of the Satsuma is borne on the interior of the tree, where there is very little direct sunlight.

In shaping the tree, therefore, aim to secure a low head, with upright branches, and well balanced top.

(2) Removal of dead, diseased, or broken branches. This should be done promptly, at any time of the year that the dead, diseased, or broken branches are noticed. Do not wait until a certain "season" to do the work. In all pruning work, and especially with the removal of larger branches, make the cut flush with the part from which the branch is removed. Never leave a stub. In the case of newly set trees, there is often a slight dying back of the small branches. Keep the dead portions cut back to live wood; this work should be given close and frequent attention until all the branches have started into vigorous growth.

(3) Removal of suckers from the stock. When suckers start from the seedling stock on which the Satsuma is budded, they should be removed

promptly. Shoots from Citrus trifoliata—the stock commonly used—make a very rapid growth, and materially hinder the growth of young Satsuma trees especially.

Frost Protection: The only method used for protecting the Satsuma trees in this section against cold is mounding. Soil is mounded up twelve inches high around the lower part of the tree. In case of a freeze severe enough to kill the top of the tree, the part above the bud union protected by the soil would furnish new growth the next season. This mounding should be done to the young trees as soon as they are set. Remove the mounds in the spring of each year. Trees of bearing age are apparently much more resistant to frost injury than younger trees, other conditions being equal.

As discussed under selection of the grove site, good air drainage is of great importance in the prevention of frost injury. In addition good judgment must be used as to cultivation, fertilizing, and spraying for maintaining vigorous trees, with well matured wood to carry through the winter season.

PROPAGATION

The Satsuma orange is generally propagated by budding, Citrus Trifoliata being the stock used. Citrus Trifoliata is a deciduous thorny bush or tree which sheds its leaves late in winter, being different in this respect to most citrus plants which are evergreen. The small fruits are worthless for eating purposes. They are filled with seeds, which should be left in the fruit until time to plant in the field in November, December or January. The method followed here at Poplarville was as follows: The seed were planted in rows 3½ feet apart, the seed being dropped 3 to 4 inches apart in the rows, the rows having been well fertilized, and were given good clean cultivation throughout the season. During the dormant period, at the end of the first season the seedlings were transplanted to nursery rows 3½ feet apart, spaced 12 to 15 inches apart in the rows, giving approximately 10,000 Citrus Trifoliata seedlings to the acre. These were budded during May and June of the following spring and buds forced into growth as soon as they caught—about 2 to 3 weeks after budding. This forcing is done by cutting the tops off about 2 inches above the buds. A one to two foot tree is possible by the following fall, large enough for orchard planting. However, these small trees can be held in the nursery another year if desired. The seedlings on which the buds fail to catch in the spring work may be budded again in August or September, using buds from the same season's growth.

Some nurserymen plant the Citrus Trifoliata seed in beds, growing a small seedling by fall, which has to be transplanted and grown another season before budding. While the method described above requires more land the first year, time is gained by being able to bud the stock about a year ahead of the second method. Transplanting of seedlings once before budding is desirable, as a better root system is established.

Budwood is cut in December or January previous to the time for budding. Branches of the past season's growth are cut, leaves trimmed off and the bud sticks then stored in a cool shady place in moist sand or moss. Budwood should of course be selected from healthy vigorous trees. In addition, judging from the marked success attained in California, special attention

should be paid in selecting the propagating wood from prolific trees which bear a high quality fruit. Even on just one limb of a tree superior fruits are often borne, and buds taken from such limbs tend to reproduce the desired characteristics.

The process of budding is quite simple. A shield shaped piece is cut from the bud stick containing the bud and a piece of leaf stalk. This is inserted in a T-shaped incision in the seedling stock 1 inch or 2 inches above the ground, and securely wrapped with raffia or a strip of waxed cloth.

If the Citrus Trifoliata seed is kept in the fruits until planting time a good germination should secured, giving 1000 to 1500 plants per pound of seed.

HARVESTING AND MARKETING

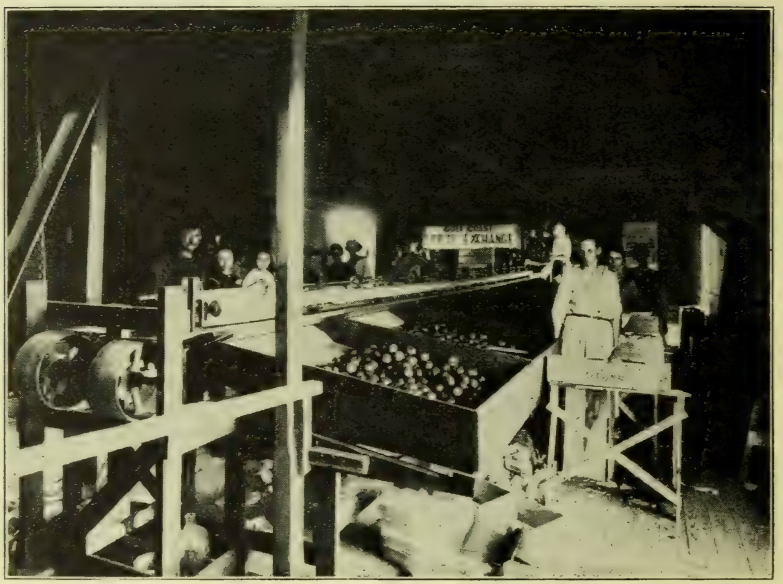
Harvesting. As with all fruits the Satsuma orange must be handled carefully. Any operations which would result in punctures or bruises of the fruit must be avoided. The fruits should not be pulled from the tree, because this method followed by careless pickers would result in breaking the skin at the stem end. Special orange clippers are obtainable for cutting the fruit from the tree, and are so constructed that the stem is cut close to the fruit, thereby leaving no projecting stem for puncturing other fruits in the boxes. Picking boxes for use in the groves should be constructed with high ends, so that in stacking the boxes no fruit will be bruised.

While the period of harvesting may extend over one or two months if desired, it is possible to harvest the bulk of the fruit at one picking. The full sugar content of the Satsuma is developed early in the ripening stage so that the quality of the fruit is not impaired if harvested before it is dead ripe.

Marketing. While the first stage in marketing a fruit crop is generally considered to be giving the fruit the proper pack, it should be emphasized that the preparation of the fruit for market should start in the grove with proper cultivation, fertilizing, spraying, pruning, for the production of clean, bright fruit of desirable size. The production of a superior quality fruit obviously facilitates its marketing.

Mississippi Satsuma growers are fortunate in being able to enlist the services of the Gulf Coast Citrus Exchange, an established marketing organization originated by the Citrus growers at Gulfport, Mississippi, in 1910, and now headed by Dr. O. F. E. Winberg of Silverhill, Alabama. This exchange supervises the construction and equipment of cooperative packing houses, and the cooperative marketing of fruit from the entire Satsuma belt. In addition the exchange advises on cultural methods, such as fertilizing and spraying, and mixes its own fertilizers and spray materials for sale to the members of the exchange at cost. At present there is only one branch of the Gulf Coast Citrus Exchange in Mississippi—the Harrison County Citrus Growers Association which has its packing house at Lyman on the G. & S. I. Railroad. Another packing house is being built at Long Beach. The oranges from these districts are handled by the packing house where they are properly graded, wrapped and packed under expert supervision. The central office of the exchange at Mobile then directs the distributing of

the fruit to the best markets. One of the first cars from the packing house at Lyman in the fall of 1922 went to Montreal, Canada in good condition. The Satsuma box is 12 inches by 26 inches by 6 inches. The number of oranges packed in this box ranges from 96 to 288, the medium sizes being in better demand on the market.



Modern Packing House at Lyman, Miss.

YIELDS, COSTS, AND PROFITS

Because of the newness of the Satsuma industry, information on these points is quite limited. As in any business, some individuals make a very flattering success under favorable conditions and good management, while others make only fair profits. Some neglected groves, or groves on improper sites, are operated at an actual loss. If the grove is properly situated, and given good management, the Satsuma will compare favorably with any other fruit industry in the United States, present indications being that it will prove even more profitable. The trees are very prolific, the fruit is of superior quality and the first orange on the market, while the territory adapted to successful culture is quite limited. In well managed bearing groves which have come under observation there has been a crop each year, and this is the testimony of all growers consulted where all cultural conditions have been favorable. A national authority on Citrus fruits made the statement recently that the Gulf Coast Citrus industry was organized and is being operated on a higher plane than any other citrus section in the United States, and that the Satsuma is destined to be a gold mine to the growers in the Gulf Coast section.

The following yields and returns are given as an indication of what the Satsuma is doing:

In 1922, 6500 trees in their fourth season yielded 1975 boxes of marketable fruit. This is practically one-third box per tree, and on the basis of 70 trees per acre (25 feet by 25 feet) would be equivalent to 21 boxes per acre.

One 4½ acre grove gave a return of $3500 with the average price of $3 per box. This is equivalent to a yield of 259 boxes per acre, and a gross income of $777 per acre.

Six 8-year old trees on a farm near Logtown, Miss., averaged 3000 oranges each, equivalent to 16 boxes per tree. (Basis of 180 average per box.)

In one grove of 300 trees, the crop for the third and fourth seasons after planting paid for the grove, according to the owner.

An 18-acre grove yielded 4000 boxes that sold for $3 to $5 each.

Ten acres gave a return of $10,000 and the same grower on a small number of trees produced a yield up to $3000 per acre.

534 trees in the 11th year gave a return of over $9000.

It is not intended to convey the idea that each and every grower can expect returns such as given above, though a visit to bearing groves which have been given good care will convince any one that the Satsuma is very prolific. At first glance, the last figures given, $9000 return from 534 trees in their 11th year, may look unreasonable. However, 6 boxes of oranges per tree at $2.80 per box would give this return. Under good conditions, 6 boxes for 11-year old trees is quite possible.

The following is quoted from a letter from a Mississippi grower who has made a good success with Satsumas:

"Trees will cost about 50 cents each, fertilizer five cents per tree for the first year, labor for setting 15 cents per tree * * * At ten years the tree should get 30 pounds of fertilizer each and produce 8 or 10 boxes to the tree. They will show a profit, or should, when three years old. It will cost $1.05 to pick, pack, and put in dealer's hands. Spraying and cultivation are essential * * * Price in 1921 ranged from $2.50 per box, some bringing as high as $4.00."

The following statements regarding costs of Citrus fruit production in California, are taken from the February, 1923 issue of the American Fruit Growers Magazine:

"Orchard costs in the production of oranges and lemons in Southern California are probably greater per acre of bearing orchard than are the costs of any other commercially grown fruit in the United States. During the past ten years growers have spent each year an average of $185.00 per acre in the production of oranges, and $240.00 in the production of lemons, exclusive of the cost of picking the fruit."

In contrast to these figures, note the following statement given on page 43, Farmers' Bulletin 1122, ("Citrus Fruit Growing in the Gulf States").

"The annual cost of maintaining a grove in Florida after it reaches bearing age averages from $75 to $150 per acre. When all or most of the labor is performed by the grove owner the cash expenditure of starting and maintaining a grove may be reduced a third or even more."

It should be said that the cost of maintaining bearing groves of Satsumas would very likely be less than for the larger trees of oranges and grapefruit in Florida.

WILL SATSUMA ORANGE PLANTING BE OVERDONE?

A similar question has been asked concerning most of the commercial fruits now grown in the United States. It was asked repeatedly during past booms in apple planting. In 1919, there were nearly 2½ million acres of bearing apple trees in the United States, and the total production in 1920 was 223,677,000 bushels. (U. S. D. A. Year Book, 1921). And we are still paying forty to ninety cents per dozen for apples. The packing of high-grade fruit, good business methods in distribution, with an increased population, took care of the greatly increased production.

It does not seem possible that there can be an over-production of Satsuma Oranges, especially when the following points are considered:

1. The extent of territory in the United States adapted to commercial production is quite limited. Future plantings will be largely confined to the coastal region of Mississippi, Alabama, Louisiana, and Northwest Florida.

2. The Satsuma is the first orange on the market.

3. The superior quality of the fruit will stimulate a large and increasing demand.

At present only a few of the consuming markets in the United States are familiar with this fruit. The production centers are within easy reach of the largest consuming centers of the United States, and with the distributing service of the Gulf Coast Citrus Exchange already in operation, it seems inevitable that there will be an unlimited, profitable demand for this high class dessert fruit at all times in the future.

Prospective investors are urged to visit this section during harvesting season, October and November, to make independent observations concerning this important Horticultural industry.

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Bulletin 218. June, 1923.

Grazing and Feeding Trials with Hogs

By
E. BARNETT AND C. J. GOODELL*

Fall pigs averaging 187 pounds at an average age of 180 days
Corn versus Rice Polish Work—Spring 1922.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi.
J. R. Ricks, Director.

*The trials reported herein conducted from 1916 to 1918, inclusive, were under the supervision of H. K. Gayle, while those conducted from 1919 to 1920, inclusive, were under the supervision of D. J. Griswold. Those since the spring of 1921 were conducted by the authors.

Soy Beans Grazed Alone and with Corn, and Soy Beans Grazed with Corn Hand-Fed in Varying Amounts—Summary of Work from 1917 to 1922, inclusive.

Cowpea Grazing—1917 and 1918.

Peanut Grazing—1919, 1920, 1921, and 1922.

Velvet Beans Grazed Alone and with Corn, and Velvet Beans Grazed with Corn Hand-Fed—1917-18.

Protein Supplements—1918-19.

Corn and Cottonseed Meal—1921-22.

Blackstrap Molasses Fed with Corn, Shorts, and Tankage—1919.

Rice Polish and Tankage Versus Corn and Tankage—1922 and 1923.

Brewers Rice—1922-23.

Garbage Feeding—1918-19.

Corn and Tankage Self-Fed in Dry Lot—Fall of 1919 to Spring of 1923, inclusive.

Soy Beans and Corn

SOY BEANS GRAZED ALONE AND WITH CORN, AND SOY BEANS GRAZED WITH CORN HAND-FED IN VARYING AMOUNTS.

Summarizing Trials Reported in Circular 49, Mississippi Experiment Station.

The soy bean holds high rank among the great number of legume crops of the South, both as a soil improver and as a feed for livestock. Used with corn it is one of the most valuable crops grown in Mississippi for the production of pork. From the standpoint of economy corn and soy beans have proven the most satisfactory of any crops that have been used in the finishing of spring pigs at the Mississippi Experiment Station, and the results of experimental work indicate the importance of their greater utilization for this purpose by farmers of the State.

CONCLUSIONS

Growing Soy beans and corn together is more economical than growing them separately, the two crops produced on the same land representing a greater total feeding value than either grown alone.

To enable utilizing the crop in finishing hogs for the earliest possible market, soy beans and corn should be planted as early as possible after the danger from frost. The beans may be planted at the same time as the corn by driving back over the row made in planting the corn, setting the planter to put the beans in the ground just deep enough to barely insure covering.

Where soy beans and corn are grown together the results of experiments conducted by the Mississippi Experiment Station indicate that it is usually most economical to gather the corn and graze the beans, hand-feeding corn in amounts up to two and one-half per cent of the live weight of the hogs.

The pigs should be well grown and where of the spring farrow should weigh when turned on to the beans from one hundred to one hundred and thirty pounds. With an ordinarily good crop of beans, five or six shoats may be used per acre and the beans should be grazed out in about six weeks. Where grazing soy beans and corn as grown together, it is advisable to first put pigs for a short time on soy beans alone until they develop a liking for the beans.

TABLE I—SUMMARY—SOY BEANS GRAZED ALONE AND WITH CORN, AND SOY BEANS GRAZED WITH CORN HAND-FED IN VARYING AMOUNTS.

(20 Trials covering six years and involving 254 hogs)

	Number of Trials	Average Daily Gain per Hog	Pork Produced Per Acre	Corn Fed per cwt. of Gain
Soy Beans grown alone and grazed	3	1.11	263.	—
Soy Beans grown with corn the corn gathered and the beans grazed	4	1.12	231.*	—
Soy Beans grazed supplemented by small amount of corn hand-fed	3	1.39	315.8	108.3
Soy beans grazed supplemented by medium amount of corn hand-fed	5	1.50	446.5†	209.6
Soy Beans and Corn grown and grazed together	5	1.41	479.1‡	—

According to data compiled from numerous experiments, the equivalent in value of about five hundred pounds of corn is required to make one hundred pounds of gain with hogs of the size used in these trials. Calculated on this basis, where a small amount of corn was hand-fed, the average amount of pork produced per acre credited to the beans was 247.4 pounds, while where a medium amount of corn was fed the pork per acre credited to beans was 259.3 pounds. Where the beans and corn were grown and grazed together, estimating conservatively an average yield of twenty-five bushels of corn per acre, the pork credited to the beans was 199.1 pounds. The daily gain where beans and corn were grown and grazed together was greater in most instances than where the corn was hand-fed in limited amounts, the average in the preceding table being reduced by a single trial in 1919 in which were used seventy-five hogs of ordinary breeding and quality.

*Average of 3 trials.
†Average of 4 trials.
‡Average of 4 trials.

Cowpeas Grazed

1917 and 1918.

Cowpeas like soy beans are valuable as soil builders. They are usually considered, however, as more strictly a hay or forage crop while soy beans are looked upon more as a seed crop. In 1917 and 1918 trials were conducted at this Station in which pigs were grazed on cowpeas alone. That when poorly fruited, cowpeas grazed alone make slow and expensive gains was indicated by the first of these trials, while the second trial indicated a per acre value of well-fruited peas approximately equal to that of soy beans.**

In the fall of 1917, eight shoats (purebred Duroc-Jerseys) averaging 126.75 pounds were turned on 1.5 acres of cowpeas. The peas had made a rank growth but showed very little fruit. What fruit there was in the field was ripe and a second growth of vines had already started. The pigs were turned into the field August 29 and the cowpeas were completely exhausted September 26. During the twenty-eight days the pigs but little more than maintained their weight, making an average daily gain per head of only .17 pounds, the pork produced per acre being only 25.3 pounds.

In the fall of 1918, ten shoats averaging 111.5 pounds were turned on 1.75 acres of cowpeas. The peas showed a luxuriant growth of vines and a good crop of fruit. On August 23 when the pigs were turned into the field about two-thirds of the pods were ripe. The cowpeas were exhausted September 28. During the thirty-six days the pigs made an average daily gain per head of 1.1 pounds, 226.3 pounds of pork being produced per acre.

TABLE II—SUMMARY OF TRIALS WITH GRAZING COWPEAS.

YEAR	1917	1918
Length of Trial (Days)	28.	36.
Number of Hogs Used	8.	10.
Area Grazed (acres)	1.5	1.75
Average Initial Weight (lbs.)	126.75	111.5
Average Final Weight (lbs.)	131.5	151.1
Average Gain per Hog (lbs.)	4.75	39.6
Average Daily Gain per Hog (lbs.)	**.17**	**1.1**
Pork Produced per Acre (lbs.)	**25.3**	**226.3**

**In one test reported by former Director E. R. Lloyd in 1906, one acre of cowpeas grown on thin hill land produced 350 pounds of pork. In another test on rich valley land one acre of cowpeas produced 483 pounds of pork. The hogs were put into the field when the peas were nearly ripe.

Peanuts

Peanuts are adapted to the lighter soil types and, while in the northern part of the State they are neither as popular nor are they probably as valuable for grazing purposes as soy beans, in some sections, notably in our southern counties, they are of considerable importance in the production of pork. Though the work with peanuts at this Station was planned primarily to determine their influence on the carcass, as well as that of other feeds used in subsequent finishing periods, the data published herein are for the purpose of furnishing information on the number of hogs to use, the length of grazing period, the rate of gain, and the pork which may be produced with peanuts in this section of the State, as well as the most practical methods of grazing.*

PEANUTS GRAZED ALONE VERSUS PEANUTS GRAZED SUPPLEMENTED WITH CORN AND COTTONSEED MEAL SELF-FED.

In the fall of 1920, sixteen pigs averaging 47.12 pounds were divided into two lots of eight each. Lot I was grazed on peanuts alone while lot II was grazed on a comparable area of peanuts and in addition was allowed access to a self-feeder containing a mixture of two parts ground corn and one cottonseed meal. Lot II receiving corn and cottonseed meal made forty pounds more gain than lot I on peanuts alone. To produce this extra gain the pigs in lot II consumed 258.5 pounds of the mixture of corn and cottonseed meal, the small consumption of grain evidencing the palatability of the peanuts.

*Experiments conducted by this Station and by the Georgia, North Carolina, and South Carolina Stations in cooperation with the United States Department of Agriculture have shown that when hogs started at a weight of approximately one hundred pounds are fed on peanuts for a period of sixty days, a soft carcass is produced and that while they may be made firmer by a subsequent feeding of hardening feed, it is yet impossible from the data available to recommend a practical method of producing a strictly hard carcass from such hogs.

TABLE III—PEANUTS GRAZED ALONE VERSUS PEANUTS GRAZED AND SUPPLEMENTED WITH CORN AND COTTONSEED MEAL.

Grazing Period.....October 20, 1920 to November 17, 1920

LOT	I	II
	Peanuts Grazed Alone	Peanuts Grazed Supplemented with Corn and Cotton-Seed Meal
Number of Pigs Used	8.	8.
Length of Grazing Period (days)	28.	28.
Average Initial Weight (lbs.)	47.12	47.12
Average Final Weight (lbs.)	83.37	88.37
Average Gain per Pig (lbs.)	36.25	41.25
Average Daily Gain per Pig (lbs.)	**1.29**	**1.47**
Grain fed per Pig (lbs.)	—	32.5
Average Amount of Grain fed daily (lbs.)	—	1.16
Grain fed per cwt. of gain (lbs.)	—	**78.9**

GRAZING TRIALS—1919, 1921, AND 1922.

In addition to the work just reported, grazing trials with peanuts were conducted in 1919, 1921, and 1922. The stand during each of the latter two years was probably less than fifty per cent of normal which accounts for the small amount of pork produced per acre in these trials. The figures for 1919 are therefore more nearly representative of the results which may be expected in this section of the State with an ordinarily good crop of peanuts. The yield of peanuts that year was estimated at 45 bushels per acre. In 1922 the average daily gain per hog was smaller than either of the other years, owing partially to the scarcity of peanuts in the field during the last week of the trial.

TABLE IV—
SUMMARY OF PEANUT GRAZING—1919, 1921, AND 1922.

Year	1919	1921	1922
Date of Starting	Oct. 15	Sept. 30	Oct. 6
Area Grazed (acres)	2.3	4.75	4.75
Number of Hogs Used	12.	12.	12.
Length of Grazing Period (days)	36.	39.5	38.5
Initial Weight, total (lbs.)	1389.	1161.	1515.
Average Initial Weight (lbs.)	115.75	96.7	126.3
Final Weight, total (lbs.)	2190.	2050.	2153.
Average Final Weight (lbs.)	182.5	170.8	179.4
Total Gain (lbs.)	801.	889.	638.
Average Gain per Hog (lbs.)	66.75	74.08	53.2
Average Daily Gain per Hog (lbs.)	**1.85**	**1.88**	**1.38**
Pork Produced per Acre (lbs.)	**347.8**	**187.16**	**134.32**

Velvet Bean Grazing for Fattening Hogs

1917-18.

In the fall of 1917 a trial was planned by the Mississippi Experiment Station for the purpose of securing data on the grazing value of velvet beans. Four lots of six hogs each were used and were handled as follows:

Lot I was grazed on velvet beans as grown alone.

Lot II was grazed on velvet beans which had been grown with corn, the corn having been gathered before the hogs were turned on to the field.

Lot III was grazed on velvet beans which had been grown with corn, the corn having been gathered and the beans being supplemented with corn hand-fed.

Lot IV was grazed on velvet beans and corn as grown together in the field.

TABLE V.—SUMMARY OF VELVET BEAN GRAZING FOR FATTENING HOGS, 1917-18.

LOT	I	II	III	IV
RATION	Grazing Velvet Beans Alone	Grazing Velvet Beans grown with corn, the corn gathered	Grazing Velvet Beans grown with corn, the corn gathered and the beans supplemented with corn hand-fed	Grazing Velvet Beans and Corn as grown together
Date of Starting	Oct. 31	Oct. 25	Oct. 25	Oct. 25
Area Grazed (acres)	1.25	1.	1.	1.
Number of Hogs Used	6.	6.	6.	6.
Length of Grazing Period (days)	57.	70.	90.	81.
Average Initial Weight (lbs.)	125.5	118.7	130.7	121.7
Average Final Weight (lbs.)	160.5	147.7	224.	196.
Total Gain (lbs.)	210.	174.	560.	446.
Average Gain per Hog (lbs.)	35.	29.	93.3	74.3
Av. Daily Gain per Hog (lbs.)	**.61**	**.41**	**1.04**	**.92**
Corn Fed (lbs.)	—	—	2655.1	—
Corn Fed per Hog (lbs.)	—	—	442.5	—
Average Amount of Corn fed per Hog per day (lbs.)	—	—	4.92	—
Corn Consumed per cwt. of gain (lbs.)	—	—	**474.1**	**330.***
Pork Produced per Acre (lbs.)	**168.**	**174.**	**560.**	**446.**

*Based on yield of 26.3 bushels.

In all lots the beans used were the Early Speckled. Those in lot I were in rows four feet apart, while in the other lots the corn and beans were in alternate rows three and one-half feet apart, each thinned to two feet apart in the row. The yield of corn in lot II was 26.3 bushels and the yields in lots III and IV were estimated to have been the same. The beans in all lots were well fruited, the yields in lots II, III, and IV being estimated each at eight hundred pounds of beans and pod. It was estimated in all instances that about ninety per cent of the beans were matured at the beginning of the grazing period. No shelter was provided in any of the lots.

The hogs in lot I were purebred Duroc-Jerseys while those in the other lots were good grades of mixed breeding.

Considering that the equivalent in value of 500 pounds of corn is required per hundred pounds of pork produced, 151.4 pounds of pork per acre may be credited to the beans in lot IV and only 29 pounds in lot III. The hogs receiving a regular daily feed of corn equal in amount to about three per cent of their weight evidently did not become sufficiently hungry to make efficient use of the beans. Better results were secured from the beans where the corn and beans were grazed together than where the beans were grazed and the corn hand-fed. Possibly in grazing the corn the beans being broken down became more palatable upon absorbing moisture from the ground.

In lot IV the corn being more palatable than the beans was exhausted December 6, after which date the hogs were forced to graze on beans alone. Up to December 6 the hogs in lot IV made an average daily gain of 1.33 pounds, while for the rest of the period the average daily gain was only .47 pounds. The pigs in lot I where the beans were grown alone made more rapid gains than those in lot II where the beans were grown with corn, the corn having been gathered, indicating a larger daily consumption of beans in lot I.

Though lot I contained a larger area than either of the other lots and the pork produced per acre was very nearly the same as in lot II, the grazing period was the shortest of any of the lots. The evidently greater consumption of beans in lot I from the beginning was probably due to the fact that the beans being down on the ground, the absorption of moisture increased their palatability. The small differences in the initial weight of the hogs and in the dates of starting, as well as the accessibility of the beans, however, may also have been contributing causes. There is a probability that the beans being down on the ground more in lot I than in the other lots there was some greater waste from tramping which might have accounted for the slightly smaller amount of pork made per acre than in lot II.

Velvet Beans Fed in Dry Lot

1917-18.

To secure further data on the feeding of velvet beans, in the winter of 1917 sixty pigs were divided into twelve lots of five each. These were of mixed breeding and of fairly good quality, averaging at the beginning of the trial 100.8 pounds. While lacking uniformity within the lots, the lots were comparable one with another. Starting December 18, 1917 they were fed for eighty-four days as follows:

GROUP I. VELVET BEANS IN THE POD, VELVET BEAN AND POD MEAL, THRESHED VELVET BEANS, AND SHELLED CORN.

Lot I. Velvet beans in the pod ad libitum.

Lot II. Velvet bean and pod meal self-fed.

Lot III. Threshed velvet beans self-fed.

Lot IV. Shelled corn self-fed.

GROUP II. VELVET BEANS IN THE POD, VELVET BEAN AND POD MEAL, THRESHED VELVET BEANS, AND SHELLED CORN, EACH FED WITH COTTONSEED MEAL IN THE PROPORTION OF 8 TO 2 FOR 56 DAYS AND WITH TANKAGE IN THE PROPORTION OF 9 TO 1 FOR 28 DAYS.

Lot V. Velvet beans in pod 80 per cent and cottonseed meal 20 per cent for 56 days ad libitum, velvet beans in pod 90 per cent and tankage 10 per cent for 28 days ad libitum.

Lot VI. Velvet bean and pod meal 80 per cent and cottonseed meal 20 per cent for 56 days ad libitum, velvet bean and pod meal 90 per cent and tankage 10 per cent for 28 days ad libitum.

Lot VII. Threshed velvet beans 80 per cent and cottonseed meal 20 per cent for 56 days ad libitum, threshed velvet beans 90 per cent and tankage 10 per cent for 28 days ad libitum.

Lot VIII. Shelled corn 80 per cent and cottonseed meal 20 per cent for 56 days ad libitum, shelled corn 90 per cent and tankage 10 per cent for 28 days ad libitum.

GROUP III. VELVET BEANS IN THE POD, VELVET BEAN AND POD MEAL, AND THRESHED VELVET BEANS, FED IN EACH INSTANCE WITH SHELLED CORN IN THE PROPORTION OF 4 TO 6, AND CORN AND COTTONSEED MEAL SELF-FED, FOLLOWED BY CORN AND TANKAGE SELF-FED.

Lot IX. Velvet bean in pod 40 per cent and shelled corn 60 per cent ad libitum.

Lot X. Velvet bean and pod meal 40 per cent and shelled corn 60 per cent ad libitum.

Lot XI. Threshed velvet beans 40 per cent and shelled corn 60 per cent ad libitum.

Lot XII. Shelled corn and cottonseed meal self-fed 56 days, and shelled corn and tankage self-fed 28 days.

Lots IV, VIII, and XII were included as checks for comparing the results from feeding these rations more commonly used with the results from feeding rations in which velvet beans were used either as a substitute for corn or as a supplement to this feed.

The purpose, as outlined in the plan of the experiment, was to allow the pigs all that they would consume of their respective rations. It was necessary, however, to limit the total amount of feed when threshed beans or velvet bean and pod meal were used as supplements to corn, as when not limited the pigs ate the corn leaving the beans in the trough.

TABLE VI. SUMMARY GROUP I.

LOT	I	II	III	IV
RATION	Velvet Beans in Pod ad libitum	Velvet Bean and Pod Meal Self-fed	Threshed Velvet Beans Self-fed	Shelled Corn Self-fed
Average Initial Weight (lbs.)	97.74	101.14	102.8	100.54
Average Final Weight (lbs.)	124.8	102.6	131.3	167.1
Average Gain per Hog (lbs.)	27.06	1.46	28.5	66.56
Average Daily Gain per Hog (lbs.).	**.32**	**.002**	**.4**	**.79**
Av. Feed consumed per Hog (lbs.)	302.33	225.1	218.5	326.8
Average Daily Ration (lbs.)	3.6	2.68	2.6	3.89
Feed Consumed per cwt. of gain (lbs.)	**1117.27**	**15417.8**	**766.66**	**491.**

The largest and most economical gains in this group were made by lot IV receiving corn, four hundred and ninety-one pounds of shelled corn being required per cwt. of gain. In comparing lots I and III, it will be noted that while the latter made only slightly larger daily gains, forty-six per cent more beans in the pod were required per cwt. of gain than were required of threshed beans.* The pigs in lot II consumed scarcely more velvet bean and pod meal than was required for maintenance.

*According to figures showing the shelling percentage of velvet bean varieties secured from the Georgia Experiment Station, Early Speckled beans in the pod shelled out 74.1 per cent of beans.

TABLE VII. SUMMARY GROUP II.

LOT	V	VI	VII	VIII
RATION	Velvet Bean in Pod 80% C. S. M. 20% ad libitum for 56 days Velvet Bean in Pod 90% Tankage 10% for 28 days.	Velvet Bean and Pod Meal 80% C. S. M. 20% ad libitum for 56 days Velvet Bean and Pod Meal 90% Tankage 10% for 28 days.	Threshed Velvet Beans 80% C. S. M. 20% ad libitum for 56 days. Threshed Velvet beans 90% Tankage 10% for 28 days.	Shelled Corn 80% C. S. M. 20% ad libitum for 56 days. Shelled Corn 90% Tankage 10% for 28 days.
Average Initial Weight (lbs.)	97.34	100.4	93.06	105.2
Average Final Weight (lbs.)	128.5	123.4	119.2	161.4
Average Gain per Hog (lbs.)	31.16	23.	26.14	56.2
Av. Daily Gain per Hog (lbs.)	**.37**	**.27**	**.31**	**.67**
Average Feed Consumed per Hog				
Velvet Beans (lbs.)	284.92	208.03	193.96	—
Corn (lbs.)	—	—	—	329.6
Cottonseed Meal (lbs.)	45.9	32.37	29.57	53.42
Tankage (lbs.)	11.2	8.4	8.4	12.88
Average Daily Ration				
Velvet Beans (lbs.)	3.39	2.48	2.31	—
Corn (lbs.)	—	—	—	3.92
Cottonseed Meal, 56 days (lbs.)	.82	.58	.53	.95
Tankage, 28 days (lbs.)	.4	.3	.3	.46
Feed Consumed per cwt. of Gain				
Velvet Beans (lbs.)	**914.36**	**904.47**	**742.**	**—**
Corn (lbs.)	**—**	**—**	**—**	**586.52**
Cottonseed Meal (lbs.)	**147.37**	**140.72**	**113.1**	**95.02**
Tankage (lbs.)	**35.94**	**36.52**	**32.1**	**22.78**

In this group lot VIII, receiving corn and cottonseed meal for fifty-six days and corn and tankage for twenty-eight days, made the best showing both from the standpoint of average daily gains and economy of feed consumed per cwt. of gain. These gains, however, were smaller and more expensive than would ordinarily be expected. Lot V in which velvet beans were fed in the pod required twenty-six per cent more feed per cwt. of gain, making slightly greater gains than lot VII where shelled beans were used. The smallest and most expensive gains

in this group were made in lot VI in which the greater proportion of the ration consisted of velvet bean and pod meal.

TABLE VIII SUMMARY OF GROUP III.

LOT	IX	X	XI	XII
RATION	Velvet Beans in Pod 40 per cent Shelled Corn 60 per cent ad libitum	Velvet Bean and Pod Meal 40 per cent Shelled Corn 60 per cent ad libitum	Threshed Velvet Beans 40 per ct. Shelled Corn 60 per ct. ad libitum	Shelled Corn and C. S. M. Self-fed 56 days Shelled Corn and Tankage 28 days
Average Initial Weight (lbs.)	106.8	104.6	102.	98.26
Average Final Weight (lbs.)	171.	153.2	136.9	178.6
Average Gain per Hog (lbs.)	64.2	48.6	34.9	80.34
Av. Daily Gain per Hog (lbs.)	**.76**	**.58**	**.42**	**.96**
Av. Feed Consumed per Hog.				
Velvet Beans (lbs.)	179.57	175.44	120.68	—
Corn (lbs.)	269.39	263.13	185.8	370.4
Cottonseed meal (lbs.)	—	—	—	9.8
Tankage (lbs.)	—	—	—	17.
Average Daily Ration				
Velvet Beans (lbs.)	2.14	2.09	1.44	—
Corn (lbs.)	3.21	3.13	2.21	4.41
Cottonseed Meal, 56 days (lbs.)	—	—	—	.18
Tankage, 28 days (lbs.)	—	—	—	.61
Fed Consumed per cwt. of gain				
Velvet Beans (lbs.)	**279.7**	**360.9**	**345.79**	**—**
Corn (lbs.)	**419.61**	**541.2**	**532.38**	**461.04**
Cottonseed Meal (lbs.)	**—**	**—**	**—**	**12.2**
Tankage (lbs.)	**—**	**—**	**—**	**21.16**

Lot XII, receiving corn and cottonseed meal self-fed for fifty-six days and corn and tankage self-fed for twenty-eight days, made the largest gains as well as the most economical from the standpoint of pounds of feed consumed per cwt. of gain. Lot IX, where velvet beans were fed in the pod, made the best showing of the lots in which velvet beans were fed. Lot XI in which threshed beans were used made the smallest gains, while the largest amount of feed per cwt. of gain was required in lot X receiving velvet bean and pod meal.

GENERAL SUMMARY VELVET BEAN FEEDING, 1917-18.

The gains in each group were largest in the check lots receiving no velvet beans. The gains in lot IX (group III) receiving velvet beans in the pod 40 per cent and shelled corn 60 per cent, however, were greater than those in lot VIII (group II) receiving shelled corn 80 per cent and cottonseed meal 20 per cent for fifty six days, and shelled corn 90 per cent and tankage 10 per cent for twenty-eight days. In none of the lots were the gains as large as would ordinarily be expected with pigs of the average weight used in this trial. This was probably due to the lack of uniformity and to the medium quality of the pigs.

Lot IX receiving velvet beans in the pod 40 per cent and shelled

corn 60 per cent made the best showing of either of the velvet bean lots, while the poorest showing was made by lot II receiving velvet bean and pod meal. Where velvet beans were fed in the pod, the gains made were practically as great or greater than where the beans were threshed or the beans and pods ground. In neither instance was there a sufficient economy in the feed consumed per cwt. of gain to justify the expense of hulling or grinding.

In lots VIII and XII, the feed required per cwt. of gain seems to have been excessive, perhaps owing to the medium quality of the pigs. The amount of feed consumed per cwt. of gain in lot IV was comparatively small for a ration of corn alone, the most economical gains being made in this lot, contrary to average results obtained from large numbers of experiments.

The velvet beans in the pod were apparently fairly palatable though neither the threshed beans nor the bean and pod meal were relished by the hogs. It is probable that if the beans in the pod had been soaked, their palatability would have been increased, thus increasing the consumption.

All of the hogs were sold to Morris & Company, East St. Louis, Ill., for $17.75 per cwt., killing reports being secured on lots I, IV, and IX. The following is quoted from a statement by J. G. Bayliss, representing Morris & Company: "The hogs fed on corn (lot IV) showed up better than any of the others. Those fed on 60 per cent corn and 40 per cent velvet beans (lot IX) were good but not as good as the corn fed hogs, and those fed on straight velvet beans (lot I) looked better dressed than those fed velvet beans and corn (lot IX). None of the hogs killed oily or soft."

Though owing to the small number of hogs used, no conclusions should be drawn from these data unless supported by other work of similar nature, the results indicate that velvet beans are more valuable in supplementing than in substituting corn in a ration for fattening hogs.

Considered in connection with the grazing work reported earlier in this bulletin, it would seem preferable wherever possible to utilize the velvet beans by grazing the crop rather than by gathering and hand-feeding.

For hogs, velvet beans in the pod are more palatable than when ground with the pod or shelled, these data indicating that more economical gains can be made when they are fed in this way than in either of the other forms.

Protein Supplements with Corn for Fattening Hogs

Corn alone is an expensive feed for fattening hogs, especially with prices prevailing throughout the South. An abundance of cheaply grown and manufactured protein feeds suitable for supplementing the corn ration is available to the Southern farmer and his problem is the selection of one or more of these, which when fed in combination with corn will prove most profitable.

For the purpose of securing data as to the economy of various protein feeds fed with corn to fattening hogs, the Mississippi Experiment Station in the winter of 1918-19 fed eight lots of five hogs each for a period of eighty-four days.

Lot I received corn self-fed.

Lot II received corn and alfalfa hay self-fed, free choice.

Lot III received corn and alfalfa meal self-fed, free choice.

Lot IV received corn and soy beans self-fed, free choice.

Lot V received corn and peanut meal self-fed, free choice.

Lot VI received corn and shrimp bran self-fed, free choice.

Lot VII received corn and cottonseed meal self-fed, free choice, for twenty-eight days, corn and tankage self-fed, free choice, for twenty-eight days, and corn and cottonseed meal self-fed, free choice, again for twenty-eight days.

Lot VIII received corn and tankage self-fed, free choice.

The alfalfa meal was alfalfa hay coarsely ground. The soy beans were fed whole as they came from the thresher. The peanut meal was the whole peanut finely ground with the oil extracted. Shrimp bran is a by-product of the shrimp canning industry conducted principally on the Gulf Coast.

A mineral mixture consisting of three bushels charcoal, one bushel hardwood ashes, eight pounds salt, four pounds lime, and two pounds copperas was kept before the hogs.

Drinking water was accessible to each of the lots at all times.

The hogs used were high grades, representing several breeds, and though not uniform in size, were carefully selected to equalize as far as possible the various lots by placing a representative of the different breeds in each and by making all lots as nearly equal in weight as possible. The average weight at the beginning of the trial was 110.4 pounds per head.

The initial and final weights were secured from the averages of weighings on three successive days at the beginning and close of the trial.

TABLE IX—

SUMMARY OF FEEDING TRIAL USING PROTEIN SUPPLEMENTS WITH CORN FOR FATTENING HOGS, WINTER 1918-19—Length of trial, 84 Days.

LOT	I	II	III	IV	V	VI	VII	VIII
	Corn	Corn Alfalfa Hay	Corn Alfalfa Meal	Corn Soy Beans	Corn Peanut Meal	Corn Shrimp Bran	Corn C. S. M. & Tankage*	Corn Tankage
Average Initial Weight (lbs.)	105.3	104.7	108.5	117.7	105.3	112.7	116.9	112.3
Average Final Weight (lbs.)	192.3	220.	231.5	254.1	241.5	258.5	276.3	260.7
Average Gain per Hog (lbs.)	87.	115.3	123.	136.4	136.2	145.8	159.4	148.4
Average Daily Gain per Hog (lbs.)	**1.04**	**1.37**	**1.46**	**1.62**	**1.62**	**1.74**	**1.9**	**1.77**
Average Feed Consumed per Hog								
Corn (lbs.)	444.6	535.6	578.8	598	474.4	617.	682.2	582.6
Supplement (lbs.)	—	16.8	3.2	20.6	113.8	32.4	14.2csm‡ 7.4T‡	30.2
Average Daily Ration								
Corn (lbs.)	5.29	6.38	6.89	7.12	5.65	7.35	8.12	6.94
Supplement (lbs.)	—	.20	.04	.25	1.35	.39	.25csm‡ .26T‡	.36
Feed Consumed per cwt. of Gain								
Corn (lbs.)	**511.**	**464.5**	**470.6**	**438.4**	**348.3**	**423.2**	**428.**	**392.6**
Supplement (lbs.)	**—**	**14.6**	**2.6**	**15.1**	**83.6**	**22.2**	**13.6**	**20.4**
Total	511.	479.1	473.2	453.5	431.9	445.4	441.6	413.
Dressing Per Cent, based on Market Weight**	76.7	78.31	77.89	79.52	75.4	81.3	79.93	81.

*In lot VII corn and cottonseed meal were self-fed for the first twenty-eight days, corn and tankage were fed for the next twenty-eight days, and corn and cottonseed meal were fed again for the last twenty-eight days.

‡Cottonseed meal was fed for fifty-six days and tankage was fed for twenty-eight days. The amount of each of these feeds given in the average daily ration is based on the actual length of time fed.

**Dressing percentage furnished by Swift & Company.

The largest daily gains were made by the hogs in lot VII receiving corn and cottonseed meal and corn tankage alternating, being greater in this lot during the first and third periods when the hogs were receiving cottonseed meal than during the second period when the hogs were receiving tankage. Lot VIII receiving corn and tankage ranked second in rate of gain. The smallest gains were made by lot I where corn was fed alone.

The least amount of feed per hundred pounds of gain was required in lot VIII receiving corn and tankage, while the largest amount was required in lot I receiving corn alone.

Charging feeds at the prices for which they could have been secured locally at the time of the trial, the cost of one hundred pounds of gain in lot I was $13.69; in lot II, $12.66; in lot III, $12.64; in lot IV, $12.12; in lot V, $11.63; in lot VI, $12.06; in lot VII, $11.98; and in lot VIII, $11.56.*

At the conclusion of the trial, the hogs were shipped to St. Louis and the lots sold separately, all bringing $19.65 per cwt. conditional upon killing hard.**

Corn and Cottonseed Meal

Cottonseed meal is considered a dangerous feed for hogs where fed continuously in any considerable amounts for longer than four to six weeks. As shown in the preceding trial with protein supplements, however, it may be used profitably with corn in the fattening ration where fed for short periods and in limited amounts.

In connection with experiments being conducted by this Station to determine the influence of feeds on the firmness of the carcass, in the winter of 1921-22 three hogs from one of the lots were self-fed ground corn and cottonseed meal for a period of twenty-eight days. The feeds were mixed in the proportion of two parts ground corn and one part meal and were supplied in a self-feeder to which the hogs had access at all times. The following data show satisfactory results from

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*Shelled corn was charged at $1.50 per bushel, alfalfa hay at $1.50 per cwt., alfalfa meal at $1.50 per cwt., soy beans at $2.50 per cwt., peanut meal at $2.75 per cwt., shrimp bran at $3.25 per cwt., cottonseed meal at $3.10 per cwt., and tankage at $5.10. It should be borne in mind that in the winter of 1918-19 both feed and hog prices were extremely high.

**According to a report furnished by Swift and Company, who bought the hogs, all killed hard, there being little difference in the firmness of the carcasses from the several lots.

the standpoint of both rate and economy of gain.* The hogs were in excellent thrift throughout the trial.

TABLE X—
SUMMARY OF TRIAL WITH CORN AND COTTONSEED MEAL 1921-22.

Number of Hogs Used	3	
Average Initial Weight	215.3	pounds
Average Final Weight	262.	pounds
Length of Feeding Period	28.	days
Average Gain per Hog	46.7	pounds
Average Daily Gain per Hog	**1.67**	**pounds**
Feed Consumed per Hog	196.	pounds
Average Daily Feed Consumed per Hog	7.	pounds
Feed Consumed per cwt. of Gain	**420.**	**pounds**

Blackstrap Molasses Fed with Corn, Shorts and Tankage.

FALL 1919.

To secure data on the feeding of blackstrap molasses, the Mississippi Experiment Station in the fall of 1919 divided fifteen hogs averaging 160.9 pounds into three lots of five each. All lots were fed corn, shorts, and tankage with the difference that in lots II and III molasses was substituted in different proportions for part of the corn. The following are the proportions by weight of the feeds used in each lot:

Lot I. Corn 5 parts, shorts 5 parts, tankage 1 part.

Lot II. Corn 3 parts, shorts 5 parts, tankage 1 part, molasses 3 parts.

Lot III. Corn 2 parts, shorts 5 parts, tankage 1 part, molasses 4.5 parts.

HOGS

The hogs used were farrowed in the fall of 1918, were about twelve months old, and averaged at the beginning of the trial one hundred and sixty-one pounds. During the summer, they had received a small amount of grain in addition to grazing and while neither large nor fat, they were in good thrift when started on feed.

METHOD OF FEEDING

The molasses was weighed, diluted with water, and then poured upon the other feed, the hogs having been shut away from the troughs

*References to results of investigations dealing with the influence of feeds on the firmness and quality of the carcass is made in a foot-note under Peanuts, page 6.

while the feed was being prepared. The molasses was very palatable from the start and the hogs continued to relish it for the entire period.

TABLE XI—SUMMARY OF BLACKSTRAP MOLASSES FED WITH CORN, SHORTS, AND TANKAGE.

Date of Trial.....October 11, 1919 to December 1, 1919.
Length of Trial.....51 Days
Number of Hogs per lot..... .5

LOT	I	II	III
RATION	Corn 5 parts Shorts 5 parts Tankage 1 part	Corn 3 parts Shorts 5 parts Tankage 1 part Molasses 3 parts	Corn 2 parts Shorts 5 parts Tankage 1 par Molasses 4.5 partst
Average Initial Weight (lbs.)..	160.4	161.5	160.8
Average Final Weight (lbs.)...	217.3	211.6	215.7
Average Gain per Hog (lbs.)..	56.9	50.1	54.9
Av. Daily Gain per Hog (lbs.)	**1.12**	**.98**	**1.08**
Feed Consumed per Hog			
Corn (lbs.)	141.	86.5	59.9
Shorts (lbs.)	142.2	144.2	144.2
Tankage (lbs.)	28.4	28.8	28.8
Molasses (lbs.)	—	86.5	130.6
Average Daily Ration			
Corn (lbs.)	2.77	1.70	1.18
Shorts (lbs.)	2.79	2.83	2.83
Tankage (lbs.)	.56	.57	.57
Molasses (lbs.)	—	1.70	2.56
Feed Consumed per cwt. of Gain			
Corn (lbs.)	**247.8**	**172.7**	**109.6**
Shorts (lbs.)	**249.8**	**287.8**	**263.6**
Tankage (lbs.)	**49.9**	**57.5**	**52.7**
Molasses (lbs.)	—	**172.7**	**238.7**

The dry matter and total nutrients in the ration increased as molasses was used, while the dry matter and total nutrients consumed per cwt. of gain were greatest in lot II and least in lot I. The nutritive ratio varied from 1:4.3 in lot I to 1:5.0 in lot III, widening with the use of molasses in the ration.

While the difference in gains was not great, lot I receiving only corn, shorts, and tankage made the largest daily gain followed by lot III receiving in addition to these feeds the larger amount of molasses.

Using feed prices prevailing locally at the time of the trial, the cheapest gains were made by lot I and the most expensive by lot II.*

*Corn was charged at $1.50 per bushel, shorts at $66.00 per ton, tankage at $110.00 per ton, and blackstrap molasses at sixteen cents per gallon (11.7 pounds). The cost of one hundred pounds of gain for lot I was $17.63; for lot II, $19.64; and for lot III, $17.80. It will be noted that these costs are excessive even with top heavy hogs selling from $14.50 to $15.50 per cwt. as they did in the winter of 1919-20.

Corn and Tankage Versus Rice Polish and Tankage for Fattening Fall Pigs.

By utilizing grazing crops throughout the winter, the South has an opportunity of growing and fattening fall pigs economically for an early spring market when pork supplies are generally short and hog prices comparatively high.

In the spring of 1922, thirty-two shoats of the previous fall farrow were fed out by the Mississippi Experiment Station and marketed at an average age of one hundred and eighty days, weighing one hundred and eighty-seven pounds. These pigs were fed shorts and corn while with their dams on alfalfa pasture, and after weaning were fed corn, shorts, and tankage until the latter part of February when they were divided into two lots, one receiving corn and the other rice polish, each self-fed free choice with tankage, the pigs having the run of good rye pasture. In the spring of 1923, thirty-eight more pigs were handled in similar manner except that they were on oats pasture which, during most of the season, was very short and they were started on finishing feeds at an earlier date than those in 1922.

These trials were planned in such a manner as to compare the feeding values of corn and rice polish when each were used with tankage for finishing pigs on grazing crops. In regard to the comparative values of these feeds, the results appear to be somewhat contradictory and more work is necessary before arriving at any conclusions.

CORN AND TANKAGE VERSUS RICE POLISH AND TANKAGE FOR FATTENING FALL PIGS—1922.

On February 26, 1922, thirty-two purebred Duroc-Jersey and Poland-China pigs of the 1921 fall farrow, all of which had been raised on the Station farm, were divided into two lots as nearly equal as it was possible to get them in breeding, quality, weight, and condition. The pigs at this time averaged in weight 94.2 pounds.

Lot I received corn and tankage supplied in separate compartments of a self-feeder, while lot II received rice polish and tankage fed in like manner.

The pigs in each lot were provided with shelter and were allowed the run of rye pasture, the grazing being very good during the entire trial. Water which was supplied from deep wells was accessible to both lots and salt was kept before pigs at all times.

RECORDS

All pigs used had been marked individually, usually within twenty-

four hours after they were farrowed, by a system of ear notches.* At the beginning of the trial, the pigs in each lot were recorded after which they were weighed individually three days in succession, the average of these weights being used as the initial weight. The final weights were secured in the same way. The pigs were weighed individually every seven days during the progress of the trial and the self-feeders were inspected daily to see that they were working properly and that feeds were kept constantly before the pigs, thus allowing a free choice at all times. All feeds put in or taken out of the self-feeders were weighed and accurate records kept of same.**

FEEDS AND FEED PRICES

Shelled corn grown on the Station farm was used and charged against the hogs at seventy cents per bushel. The tankage which was of high grade, guaranteed to contain sixty per cent protein, was charged against the hogs at $60.00 per ton.

From the appearance, as well as the chemical analysis, the rice polish used was not a genuine polish, though it had been purchased as such.† It rather had the appearance of rice meal or flour and, according to Dr. W. F. Hand, State Chemist, the low fat and protein contents indicated that it may have been rice meal. The cost per ton of this feed at the Experiment Station was $25.00.

*According to the Lovejoy system of marking used by this Station, which has proven very satisfactory, each notch in the lower part of the right ear stands for "one" and in the upper part for "ten", while each notch in the lower part of the left ear stands for "three" and the upper part for "thirty". A pig, therefore, with one notch in the upper part of the left ear (30), one in the lower part of the left ear (3), and two in the lower part of the right ear (1 plus 1) would be 30 plus 3 plus 2 or number 35.

**This feeding was done by C. G. Harmon, a student, under the direction of the Station Animal Husbandman.

†The following is from a report of the Chemical Laboratory of the Mississippi A. & M. College showing the analysis of a sample of the rice polish used in this trial: Moisture 11.87 per cent, Ash .75 per cent, Fat 1.02 per cent, Protein 7.81 per cent, Nitrogen-Free Extract 78.35 per cent, and Fiber .20 per cent.

TABLE XII—SUMMARY OF TRIAL WITH CORN AND TANKAGE VERSUS RICE POLISH AND TANKAGE FOR HOGS—1922.

Date of Starting Trial.....February 26
Length of Trial.....47 Days
Hogs Used.....32 Purebred Poland-Chinas and Durocs

LOT	I	II
RATION	Corn and Tankage (Self-fed)	Rice Polish and Tankage (Self-fed)
Number of Hogs	16.	16.
Initial weight, total (lbs)	1533.	1483.
Average initial weight (lbs.)	95.8	92.6
Final weight, total (lbs.)	3034.6	2949.6
Average final weight (lbs.)	189.7	184.3
Average age of hogs at conclusion of trial (days)	180.6	179.3
Gain, total (lbs.)	1501.6	1466.6
Average gain per hog (lbs.)	93.85	91.7
Average daily gain per hog (lbs.)	**2.**	**1.95**
Feed consumed, total		
Corn (lbs.)	5157.5	—
Rice Polish (lbs.)	—	5394.5
Tankage (lbs.)	471.	401.
Feed consumed per hog		
Corn (lbs.)	322.34	—
Rice Polish (lbs.)	—	337.16
Tankage (lbs.)	29.44	25.06
Average daily feed consumed per hog		
Corn (lbs.)	6.86	—
Rice Polish (lbs.)	—	7.17
Tankage (lbs.)	.63	.53
Feed consumed per cwt. of gain		
Corn (lbs.)	**343.5**	—
Rice Polish (lbs.)	—	**367.8**
Tankage (lbs.)	**31.4**	**27.3**
Cost of 100 pounds of gain	$ 5.24	$ 5.42
Selling price of hogs on market	$10.45	$10.45

At an average age of one hundred and eighty days the hogs in this trial averaged in weight one hundred and eighty-seven pounds, having gained from birth a little over a pound per day. For the forty-seven days during which the pigs were on self-feeders, the average daily gain in each instance was almost two pounds.

The concentrates consumed per cwt. of gain by lot I was only 374.9 pounds and by lot II, 395.1 pounds. The costs per hundred pounds of gain in lots I and II were $5.24 and $5.42 respectively.

At the beginning of the trial the pigs would have sold locally for $7.50 per cwt. Deducting $.75 per cwt. to take care of shipping and selling expense, they netted $9.70 per cwt. on the farm.

Both lots showed excellent finish as indicated by the selling price

on the market which was only five cents under the top, the higher price that day having been received earlier, the Station hogs being sold after the market had started to decline.

CORN AND TANKAGE VERSUS RICE POLISH AND TANKAGE FOR FATTENING FALL PIGS—SPRING 1923.

On January 5, 1923, thirty-eight purebred Hampshire, Duroc-Jersey, and Poland-China pigs of the 1922 fall farrow, averaging in weight 55.75 pounds, were divided into two lots as nearly equal as possible in breeding, quality, weight, and condition.

Lot I received corn and tankage supplied in separate compartments of a self-feeder, while lot II received rice polish and tankage fed in like manner.

The pigs in each lot were provided with shelter and were allowed the run of oats pasture though the grazing was scant throughout most of the trial. Water which was supplied from deep wells was kept before the pigs at all times and a mineral mixture was provided consisting of salt, charcoal, wood ashes, and lime.

RECORDS

At the beginning of the trial, the pigs in each lot were recorded after which they were weighed individually three days in succession, the average of these weights being used as the initial weight. The final weights were secured in the same way. The pigs were weighed individually every fourteen days during the progress of the trial and the self-feeders were inspected daily to see that they were working properly and that feeds were kept constantly before the pigs, thus allowing a free choice at all times. All feeds put in or taken out of the self-feeders were weighed and accurate records kept of same.

FEEDS

The corn used was grown on the Station farm and was charged at seventy-five cents per bushel which was the prevailing price locally at the beginning of the trial. Tankage guaranteed to contain sixty per cent protein was used, costing sixty dollars per ton. Rice polish cost thirty-six dollars per ton.*

*The following is from a report of the Chemical Laboratory of the Mississippi A. & M. College showing the analysis of a sample of the rice polish used in this trial: Moisture 12.60 per cent, Ash 6.85 per cent, Fat 13 per cent, Protein 12.38 per cent, Nitrogen-free extract 51.63 per cent. and Fiber 3.54 per cent.

TABLE XIII—SUMMARY OF EIGHT WEEKS FEEDING CORN AND TANKAGE VERSUS RICE POLISH AND TANKAGE

LOT	I	II
RATION	Corn Tankage Oats Pasture	Rice Polish Tankage Oats Pasture
Number of Hogs	19.	19.
Average Initial Weight (lbs.)	54.8	56.7
Average Weight March 2 (lbs.)	124.4	78.9
Average Gain per Hog (lbs.)	69.6	22.2
Average Daily Gain per Hog (lbs.)	**1.24**	**.4**
Feed Consumed per Hog		
Corn (lbs.)	233.5	—
Rice Polish (lbs.)	—	128.
Tankage (lbs.)	28.2	28.7
Average Daily Feed Consumed per Hog		
Corn (lbs.)	4.17	—
Rice Polish (lbs.)	—	2.29
Tankage (lbs.)	.5	.51
Feed Consumed per cwt. of Gain		
Corn (lbs.)	**335.5.**	**—**
Rice Polish (lbs.)	**—**	**575.8**
Tankage (lbs.)	**40.5**	**129.3**
Cost of 100 pounds of Gain	$5.71	$14.24

From the above data it will be seen that the pigs on rice polish and tankage were making very small and expensive gains. During the early part of the trial, some scouring was noted among the smaller pigs in this lot. Some of the lighter pigs, having made practically no gains in weight during the eight weeks, presented an unthrifty appearance and it was thought that to continue them longer would endanger losing several by death. As this sacrifice was considered unnecessary to the experiment, from March 2 lot II was allowed access to corn and tankage the same as lot I and they received no more polish after that date.

On rice polish and tankage some of the pigs having an advantage in size at the beginning of the trial made fair gains though only one of the nineteen made an average of as much as one pound per day, while the average daily gain per head for the entire corn and tankage lot was 1.24 pounds.

After being changed to corn and tankage the pigs in lot II, in practically every instance, showed rapid improvement both in thrift and condition, the only exception being a small Duroc-Jersey sow pig that made no gain for the first two weeks on corn and tankage, but for the succeeding two weeks made almost a pound per day. For the entire eight weeks on rice polish and tankage she had only gained three pounds.

TABLE XIV—

SUMMARY OF TRIAL WITH CORN AND TANKAGE VERSUS RICE POLISH AND TANKAGE FOR FALL PIGS—1923.

Date of Starting Trial—January 5.
Length of Trial—84 Days.
Hogs Used—38 purebred Duroc-Jerseys, Poland-Chinas, and Hampshires.

Methods of Feeding—Lot I was given corn and tankage, self-fed for the whole time. Lot II was given rice polish and tankage self-fed for eight weeks and corn and tankage self-fed for the remainder of the trial.

LOT	I	II
RATION	Corn and Tankage	Rice Polish and Tankage 8 weeks, Corn and Tankage 4 weeks
Number of Hogs	19.	19.
Initial Weight, total (lbs.)	1041.6	1077.6
Average Initial Weight (lbs.)	54.8	56.7
Final Weight, (lbs.)	3141.7	2349.3
Average Final Weight (lbs.)	165.4	123.7
Gain, total (lbs.)	2100.1	1271.7
Average Gain per Hog (lbs.)	110.53	66.9
Average Daily Gain per Hog (lbs.)	**1.32**	**.8**
Feed Consumed, total		
Corn (lbs.)	7783.	2819.
Rice Polish (lbs.)	—	2432.
Tankage (lbs.)	734.	763.
Feed Consumed per Hog		
Corn (lbs.)	409.63	148.37
Rice Polish (lbs.)	—	128.
Tankage (lbs.)	38.63	40.16
Average Daily Feed Consumed per Hog		
Corn (lbs.)	4.88	1.77
Rice Polish (lbs.)	—	1.52
Tankage (lbs.)	.46	.48
Feed Consumed per cwt. of Gain		
Corn (lbs.)	**370.6**	**221.67**
Rice Polish (lbs.)	—	**191.24**
Tankage (lbs.)	**34.95**	**60.**
Feed Cost per cwt. of Gain	$6.01	$8.21
Av. Selling Price per cwt. on Market	$8.48	$7.72

The final weights were the averages of three weighings on consecutive days, March 29, 30, and 31. The hogs were shipped April 3, arriving on the market and being sold April 5. The market weight of lot I was 3150 pounds and that of lot II, 2350 pounds, in both instances being practically the same as the final weights at the Experiment Station. As the hogs were continued on feed, however, for two days after

the final weighing at home, they probably made about the same average daily gains during these days that they had been making and there was probably a shrink in shipment not exceeding two per cent.

The cost of one hundred pounds of gain for the entire period was considerably higher in lot II than in lot I. That this was due to the use of rice polish during the first eight weeks is shown by the fact that the cost of one hundred pounds of gain in lot II during that time was $14.24 as compared with $8.21 for the entire period.

The comparative finish of the hogs in the two lots is shown both by the final weight and by the selling price per cwt., the lighter end going to stocker buyers. Sixteen hogs in lot I brought $8.65 per cwt. and three brought $7.25. Seven hogs in lot II brought $8.65 per cwt.; seven, $7.25; and five, $6.00. This made a difference in the average market price in favor of lot I of seventy-six cents per cwt. and the difference in the home price would have been somewhat greater as the commission and yardage charges are prorated on a "per head" rather than a "weight" basis.

PRESENT STATUS OF WORK WITH RICE POLISH AT THIS STATION.

From the widely varying results of the two trials at this Station in which rich polish and tankage were fed versus corn and tankage, it seems impossible to draw definite conclusions until further work has been done. The wide difference in the composition of the feeds used in the two trials may have had something to do with the apparently contradictory results. These results might also be taken to indicate that young pigs cannot be expected to utilize rice polish as profitably as heavier hogs, the pigs in the 1922 trial averaging at the beginning 94.2 pounds and those in 1923 only 55.75 pounds. With these points in mind it is planned to conduct further trials on the feeding of rice polish to several lots of pigs of varying ages and weights.

Brewers Rice

Brewers rice used in the manufacture of beer consists of small broken grains of rice separated from higher grades in the process of milling.* A single trial at this Station in the winter of 1922-23 indicates that it has a high feeding value for hogs, 418.4 pounds producing one hundred pounds of pork with hogs averaging at the beginning of the trial 181.7 pounds. The extent to which this feed will be used by farmers and stock raisers will be determined by its cost, that used in this trial costing forty-five dollars per ton and making the gains produced expensive as compared with those from corn and tankage, when corn could be secured around seventy-five cents per bushel. The hogs used had been grazed for six weeks on peanuts previous to being put into the dry lot where they were allowed access to a self-feeder containing brewers rice. They were purebred Duroc-Jerseys, Poland-Chinas, and Hampshires of good quality and thrift. During the last week of the grazing period, the peanuts were practically exhausted and the hogs were hungry when put on to the self-feeder which probably influenced to some extent the subsequent gains.

TABLE XV—SUMMARY OF TRIAL WITH BREWERS RICE 1922-23.

Number of Hogs Used	6.	
Initial Weight, total	1090.	Pounds
Average Initial Weight	181.7	Pounds
Final Weight, total	1638.	Pounds
Average Final Weight	273.	Pounds
Average Time on Feed	6.	Weeks
Gain, total	548.	Pounds
Average Gain per Hog	91.3	Pounds
Average Daily Gain per Hog	**2.17**	**Pounds**
Feed Consumed, total	2293.	Pounds
Feed Consumed per Hog	382.2	Pounds
Average Daily Ration	9.1	Pounds
Feed Consumed per cwt. of Gain	**418.4**	**Pounds**

*"Brewers rice contains the smallest particles of milled rice and is composed almost entirely of pieces less than one-third of a grain in size. The mill yield varies from three to thirteen pounds per barrel of rough rice, with an average of eight pounds."—Bulletin 330, U. S. Department of Agriculture.

Feeding Garbage to Hogs

1918-19.

The economical and effective disposal of garbage is a problem which confronts cities and towns in all parts of the country. According to Ashbrook and Wilson,* of sixty-six cities in the United States estimated as having populations in excess of 100,000 each in 1916, more than thirty per cent reported that their garbage was disposed of by feeding to hogs, and of five hundred and forty-four cities between 10,000 and 100,000 population, more than thirty-six per cent made like reports. The demand for pork and pork products resulting from the world war emphasized the need of information in regard to the utilization of garbage for hog feeding, and to secure data along this line, experiments were conducted by this and other stations in cooperation with the Animal Husbandry Division of the United States Department of Agriculture.

The trial at the Mississippi Experiment Station, which was under the direct supervision of W. H. Rochester, Assistant Animal Husbandman, included seven lots fed as follows:

Lot I received garbage ad libitum from the student mess hall at which was fed about fifteen hundred students enrolled in the A. & M. College.

Lot II received mess hall garbage ad libitum and in addition a limited ration of corn and tankage (corn 9 parts and tankage 1 part).

Lot III received a half ration of mess hall garbage and corn and tankage (corn 9 parts and tankage 1 part) ad libitum.

Lot IV received cafe garbage ad libitum.

Lot V received cafe garbage ad libitum and in addition a limited ration of corn and tankage (corn 9 parts and tankage 1 part).

Lot VI received a half ration of cafe garbage and corn and tankage (corn 9 parts and tankage 1 part) ad libitum.

Lot VII received corn and tankage (corn 9 parts and tankage 1 part) ad libitum.

Where the grain ration in a lot was limited, the amount fed per da was about two per cent of the live weight of the hogs in that lot. The half ration of garbage in each instance was calculated from the

*Farmers Bulletin 1133, Feeding Garbage to Hogs, summarizes briefly the results of garbage feeding experiments conducted by the Mississippi Experiment Station and others cooperatively with the United States Department of Agriculture, and discusses observations by the Department of methods employed in gathering and feeding this product.

TABLE XVI **GARBAGE TRIAL, MISSISSIPPI EXPERIMENT STATION**

LOT	I	II	III	IV	V	VI	VII
RATION	Mess Hall Garbage	Mess Hall Garbage Limited Grain Ration	One-half Ration Mess Hall Garbage Grain ad Libitum	Cafe Garbage	Cafe Garbage Limited Grain Ration	One-half Ration Cafe Garbage Grain ad Libitum	Grain ad Libitum
Number of Hogs Used	5.	5.	5.	2.	2.	2.	5.
Length of Trial (days)	70.	84.	84.	84.	84.	84.	105.
Average Initial Weight (lbs.)	138.	126.3	135.3	131.1	142.3	150.	127.5
Average Final Weight (lbs.)	232.2	245.7	265.2	230.2	248.3	274.6	296.7
Average Gain per Hog (lbs.)	94.2	119.4	129.9	99.1	106.	124.6	169.2
Average Daily Gain per Hog (lbs.)	**1.35**	**1.42**	**1.55**	**1.18**	**1.26**	**1.48**	**1.61**
Average Feed Consumed per Hog							
Garbage (lbs.)	1243.4	861.4	771.	1317.5	810.	674.5	—
Grain Mixture (lbs.)	—	326.5	430.2	—	349.8	467.	851.2
Average Daily Ration							
Garbage (lbs.)	17.76	10.25	9.18	15.68	9.64	8.03	—
Grain Mixture (lbs.)	—	3.89	5.12	—	4.16	5.56	8.10
Feed Consumed per cwt. of Gain							
Garbage (lbs.)	**1320.**	**721.44**	**593.5**	**1329.4**	**764.15**	**541.33**	**—**
Grain Mixture (lbs.)	**—**	**273.45**	**331.18**	**—**	**330.**	**374.8**	**503.07**

consumption in the lots receiving garbage alone. The number of hogs used in the lots receiving cafe garbage was smaller than desired, owing to the limited supply of this feed available.

The hogs used were high grade Duroc-Jerseys averaging in weight at the beginning of the trial one hundred and thirty-four pounds.

The amount of pork produced per ton of garbage was 151.5 pounds in lot I where mess hall garbage was used, and 150.4 in lot V where cafe garbage was used. Owing to the excellent condition of the garbage as well as to the quality of the hogs used, this was more than might be expected under average conditions.

The hogs receiving the mess hall garbage consumed a somewhat larger ration than those receiving cafe garbage and made correspondingly larger gains. The largest average daily gain was made by lot VII receiving no garbage, and the next largest by lot III receiving a half ration of mess hall garbage and grain ad libitum.

At the conclusion of the trial, the hogs were shipped to St. Louis where they were sold for $19.65 per cwt. on condition that they killed hard. Swift and Company who bought them reported that none killed soft or oily and that so far as firmness of meat in the different lots was concerned, there was little to choose, all being firm.

The dressing percentage as reported by Swift and Company was: for lot I, 78.68; lot II, 78.17; lot III, 80.64; lot IV, 78.52; lot V, 76.66; lot VI, 77.93; and lot VII, 81.04.

The following quoted from Farmers Bulletin 1133 by Ashbrook and Wilson is a summary of observations and experiments in regard to the feeding of tankage to hogs:

"Garbage varies greatly in composition, but on an average and allowing for normal losses, a ton of municipal garbage may be expected to produce forty pounds of marketable live weight of hog.

The garbage must be collected with reasonable frequency and be free from tin cans, soap, broken glass, and other undesirable or injurious foreign articles. The public should be kept informed that garbage is being fed.

Usually it is best for the cities to make the garbage collections and then dispose of the garbage to individuals, associations, or corporations on a contract basis, unless the city operates its own hog-feeding farm.

Long-time contracts are likely to be most satisfactory to all concerned; besides they tend toward a better class of equipment and more sanitary conditions.

The pigs to be fed may be bought as feeders or may be raised. Each method has given good results under suitable conditions.

Methods of feeding, handling, housing, and care may differ considerably so long as the essentials of sanitation and hog comfort are

observed. Equipment for feeding should be adapted to the type of garbage available and to local conditions, climate, and transportation.

Raw garbage generally is better for hogs than cooked garbage. Frozen garbage, however, should be thawed before feeding.

As a rule the use of grain as a supplementary feed for the garbage is not an economical practice, but may be used to advantage when the supply of garbage is temporarily short.

Hogs to be fed garbage need to be immunized against cholera, preferably by the double or simultaneous treatment. Thorough immunization is very important because of the presence of raw pork scraps frequently deposited in garbage cans.

Garbage-fed hogs show no greater susceptibility to tuberculosis, pneumonia, or kindred diseases than grain-fed animals.

Pork from garbage-fed hogs is as good in quality as pork resulting from other feeds, and average garbage-fed hogs sell at practically the same prices as average grain-fed animals."

Corn and Tankage Fed In Dry Lots

Summary of Trials at This Station.

"Corn and tankage self-fed, free choice, have made one of the most economical combinations used for feeding hogs, either in the dry lot or when grazing on green forage crops. The average feed consumed per hundred pounds of pork produced for thirteen trials in which these feeds were fed to a total of ninety-eight hogs, averaging in weight 171.6 pounds, was 435.9 pounds of corn and 23.9 pounds of tankage. The average amount of concentrates consumed per head daily was 8.22 pounds and the average daily gain per head was 1.79 pounds."

Very economical gains were made in 1919 for a short feeding period by hogs that had been grazed on soy beans either alone or supplemented with a small amount of corn during the grazing period. Next to these the least amount of feed per cwt. of gain was required in 1921 by the lot of twelve hogs which had been grazed four weeks on peanuts. This was probably due, however, largely to the fact that they were much lighter than the hogs used in other trials. The most expensive gains were made in 1922-23 with the lot which had been grazed on soy beans for six weeks, receiving in addition to the beans an amount of corn equal to two and one-half per cent of their weight.

TABLE XVII— SUMMARY—CORN AND TANKAGE SELF-FED IN DRY LOT

Results of 13 Trials using a Total of 98 Hogs.

YEAR	PREVIOUS HANDLING	Av. Length of Trial (Days)	Number of Hogs	Initial Weight (lbs.)	Average Initial Weight (lbs.)	Final Weight (lbs.)	Gain (lbs.)	Average Daily Gain (lbs.)	Feed Consumed. Total		Feed Consumed per cwt. of Gain		Concentrate Consumed Daily per Head (lbs.)
									Corn (lbs.)	Tankage (lbs.)	Corn (lbs.)	Tankage (lbs.)	
1919-20	Grazed 36 days on Peanuts	56	9	1774	197.1	2619	845	1.68	4167.5	225.	493.2	26.6	8.72
1920-21	Grazed 4 weeks on Peanuts	58	12	1003	83.6	2132	1129	1.62	4039.5	387.	357.8	34.3	6.36
1921-22	Grazed 6 weeks on Peanuts	28	6	1040	173.3	1288	248	1.48	1161.	79.4	468.1	32.	7.38
1919	Grazed 37 days on Soy Beans	14	8	1346	168.3	1666	320	2.86	997.	98.5	311.6	30.8	9.78
1919	Grazed 39 days on Soy Beans plus light Corn ration	14	9	1626	180.7	1888	262	2.08	1086.5	96.	414.7	36.6	9.38
1919	Grazed 39 days on Soy Beans plus medium Corn ration	14	9	1648	183.1	1956	308	2.44	1187.	73.	385.4	23.7	10.
1919	Grazed 41 days on Corn and Soy Beans	14	9	1662	184.7	1906	244	1.94	999.5	79.	409.6	32.4	8.56
1921-22	Grazed 47.6 days on Soy Beans	42	6	958	159.7	1492	534	2.12	2247.	87.9	420.8	16.5	9.27
1921-22	Grazed 45.4 days on Soy Beans plus light Corn ration	42	6	1130	188.3	1548	418	1.66	1990.5	35.4	476.2	8.5	8.04
1921-22	Grazed 47.6 days on Soy Beans plus medium Corn ration	42	6	1252	208.7	1700	448	1.78	2185.	52.4	487.7	11.7	8.88
1921-22	Grazed 47.6 days on Corn and Soy Beans	42	6	1246	207.7	1716	470	1.87	2103.	64.4	447.4	13.7	8.6
1922-23	Grazed 42 days on Soy Beans	42	6	1010	168.3	1460	450	1.79	2129.	78.	473.1	17.3	8.76
1922-23	Grazed 42 days on Soy Beans plus medium Corn ration	42	6	1125	187.5	1513	388	1.54	2141.	95.	551.8	24.5	8.87

Bulletin No. 219 December, 1923

COTTON EXPERIMENTS, 1923

Varieties, Fertilizers, and Weevil Control

By
J. F. O'Kelly and Rowland Cowart

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi
J. R. Ricks, Director

STATION STAFF

D. C. Hull, M. Sc.	President of College
J. R. Ricks, M. Sc.	Director and Chief in Agronomy
M. H. Moore	Secretary and Financial Agent
E. B. Ferris, M. Sc.	Asst. Director, Sout Miss. Branch Station
C. T. Ames, B. Sc.	Asst. Director, Holly Springs Branch Station
C. B. Anders, B. Sc.	Asst. Director, Raymond Branch Station
W. E. Ayers, M. Sc.	Asst. Director and Blant Breeder, Delta Branch Station
S. W. Greene	In Charge of Costal Plains Branch Station*
W. F. Hand, M. Sc., Ph. D.	Chemist
J. S. Moore, M. Sc.	Chief in Dairy Husbandry
R. W. Harned, B. S. A.	Chief in Entomology
C. F. Briscoe, A. M., Ph. D.	Bacteriologist
Geo. S. Templeton, B. Sc.	Animal Husbandman
J. M. Beal, M. Sc.	Botanist
E. P. Clayton	Poultry Husbandman
W. C. Morse, M. Sc.	Geologist
A. B. McKay, B. Sc.	Chief in Horticulture
D. C. Neal, B. Sc., M. A.	Plant Pathologist
J. N. Lipscomp, M. Sc.	Farm Economist
J. F. O'Kelly, M. Sc.	Plant Breeder
J. C. C. Price, B. Sc.	Horticulturist
Earle Brintnall, B. Sc.	Dairyman
C. J. Goodell, B. Sc.	Associate in Farm Management
H. W. Allen, B. Sc.	Entomologist
K. U. Jones, B. Sc., V. M. D.	Veterinarian
R. N. Lobdell, M. Sc.	Zoologist
W. S. Anderson, B. Sc.	Horticulturist and Assistant, South Miss. Branch Station
H. F. Wallace, B. Sc.	Assistant at Holly Springs Branch Station
H. A. York, B. Sc.	Assistant at Delta Branch Station
H. H. Harned, M. S.	Associate in Bacteriology
Rowland Cowart	Assistant Agronomist
Miss Kittie Sue Johnson, B. S.	Secretary-Stenographer
Miss Mary Alice Lanier	Addressograph Operator
Miss Fannie Page	Stenographer
D. W. McIlwain	Superintendent of Farm
D. Maxwell	Foreman and Herdsman
B. V. Evans	Farm Foreman, South, Miss. Branch Station
J. C. Ryan	Farm Foreman, Holly Springs Branch Station
J. C. Peyton	Farm Foreman, Raymond Branch Station
K. C. Livingston	Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc.	Supt. Farm Management Vocational Project
H. B. Brown, Ph. D.	Collaborator
E. C. Ewing, M. Sc.	Collaborator

*In Cooperation, Bureau of Animal Husbandry, U. S. Department of Agriculture.

COTTON EXPERIMENTS, 1923

Central Station

J. F. O'Kelly and Rowland Cowart

The results obtained from certain cotton experiments conducted at the Central Experiment Station during the season just ended are reported in this publication. The aim has been to include only those tests which are non-technical and of immediate value to the practical cotton grower. Even with cotton selling at a good price, poorly adapted varieties, diminishing soil fertility, weevil damage, and many other harmful factors menace the profitable production of cotton. The results here reported should contribute in part to the solution of these problems.

TABLE I. RESULTS FROM SIX TYPES OF COTTON AT THE CENTRAL STATION.

	Pounds Lint Cotton per Acre					
YEAR	Cook	Cleve-land	Trice	Miller	Delfos	Ex-press
1919	350.7	335.2	356.9	261.2	346.5	295.9
1920	366.0	325.0	321.0	271.0	333.0	274,0
1921	555.0	552.9	470.3	497.3	443,2	440,1
1922	334.2	315.6	279.0	320.3	262,8	271,6
1923	303.5	344.4	396.5	323.8	368,9	263,6
Five Year Average	381.9	374.6	364.6	334.7	350,9	309,0
Average Value, Dollars	107.85	110.14	126.07	107.44	131.63	113.70
Average Length, Inches	7/8	15-16	1 1/16	1 1/16	1 3/16	1 3/16
Average Lint Percentage	37.7	34.8	30.6	33.3	31.5	31.3

HIGHEST YIELDING VARIETIES

Table I indicates to a certain extent which varieties will yield the most over a period of several years. Six more or less distinct types of cotton are represented, each by a particular variety or strains of a variety. The data presented are taken from results obtained at this station and should be especially valuable after a season so extraordinarily wet as to increase greatly the inadvisability of drawing conclusions from the results of one year.

The yields given are those actually obtained on the station farm while the values are based on quotations from representative cottor markets and are probably greater for the longer staples than the average producer with no marketing system could obtain. The lengths and percentages are those which may normally be expected from these varieties.

VARIETY TESTS, 1923.

The usual number of variety tests was again run, every possible effort being made to increase their value by the proper selection of varieties to be tested, methods of conducting the tests, and other means.

The unusually heavy rainfall recorded throughout nearly all parts of the state was also experienced at A. & M. College. Probably no other factor, except on unusually well drained soils, did more to hold down yields. A rainy period just after planting injured stands somewhat. When the plants had begun to fruit frequent rains began again and continued until picking time.

TABLE II. STANDARD COTTON VARIETIES

Variety	Pounds per Acre		Lint			Dollars per Acre	Rank	
	Seed Cotton	Lint	Per-centage	Length	Cts. per Lb.	Seed and Lint	in Value	Bolls per Lb.
Miss. Sta. Trice	1262.6	396.5	31.4	1 1/16	34	156.46	1	81
Cleveland, Wan.	672.6	251.6	37.4	7/8	33 1/4	94.19	19	74
Cleveland, Piedmont	1018.3	348.3	34.2	15-16	33 1/2	133.43	4	73
Cleveland 54	984.1	344.4	35.0	15-16	33 1/2	131.36	5	70
Half and Half	836.6	321.3	38.4	3/4 f	32 1/4	116.50	9	71
Cook 588	807.1	303.5	37.6	7/8	33 1/4	113.51	10	68
Triumph	1130.4	387.7	34.3	15-16	33 1/2	148.44	2	64
Miller	935.7	323.8	34.6	1 1/16	34	125.39	6	55
Acala No. 5	804.8	293.8	36.5	1 1/16	34	112.67	12	69
Lone Star 65	882.6	299.2	33.9	1 1/8	34 1/2	117.81	8	63
Salsbury	861.4	285.1	33.1	1 1/8 f	34 1/2	112.77	11	78
Webber 49-4	689.1	211.6	30.7	1 1/4	36 1/2	89.17	20	78
Webber, Deltatype	713.9	202.7	28.4	1 1/4 f	37	87.78	22	78
Sunpress	826.0	223.0	27.0	1 1/8	38	99.82	15	78
Delfos 631	8 90.9	293.1	32.9	1 3/16 f	35 1/2	118.99	7	69
Delfos 6102	1135.2	368.9	32.5	1 3/16	35	148.28	3	78
Express, Walcott	731.6	218.0	29.8	1 3/16	35	89.14	21	67
Express 782	738.7	243.8	33.0	1 3/16	35	97.70	16	74
Express, Lightning	844.9	263.6	31.2	1 3/16	35	106.79	13	79
Express 630	833.1	258.3	31.0	1 3/16	35	104.78	14	76
D. & P. L. No. 3	739.9	230.1	31.1	1 1/4	36 1/2	96.74	17	81
Express 350	807.1	230.8	28.6	1 3/16	35	95.19	18	87

Early in the season weevils appeared in relatively small numbers and no effort was made to control them. Weevil damage was considerable before the migration date but was probably not so great as that caused by excessive rains. This applies to the station farms. On the plantation where the weevil control work was carried on weevils appeared early and in abundance which made it possible to secure the phenomenal gains from poisoning reported in this publication.

The prices used for different staple lengths were obtained from Mr. F. P. Phillips, Cotton Merchant, Columbus, Mississippi, and are based on middling cotton of the different lengths as quoted Mr. Phil-

lips on November 15 by Memphis, New Orleans, and other cities. Cotton seed was valued at $50.00 per ton.

The test of standard varieties reported in Table II was planted April 23 in six replications on Houston Clay loam. Before the test was planted the ground received 200 pounds kainit and about two tons of stable manure to the acre. No other fertilizer was used and no attempt was made to control the weevil. Poison applied late in the season for leaf worm control may have checked the weevil slightly. The standard spacing on the station farms is two plants a hoe width.

TABLE III. HILL VARIETY TEST

Variety	Pounds per Acre		Lint			Dollars per Acre	Rank in Value	Bolls per Lb.
	Seed Cotton	Lint	Percentage	Length	Cts. per Lb.	Seed and Lint		
Miss. Sta. Trice	600.3	194.5	32.4	1f	33¾	75.79	1	81
Cleveland, Wan.	333.9	124.9	37.4	13-16	32½	45.61	16	75
Cleveland, Piedmont	470.6	173.2	36.8	⅞f	33¼	65.03	2	78
Cleveland 54	430.8	152.1	35.3	⅞f	33¼	57.54	4	72
Half & Half	340.8	133.6	39.2	¾	32¼	48.27	9	74
Cook 588	342.5	132.2	38.6	13-16	32½	48.23	10	74
Miller	358.1	125.3	35.0	1f	33¾	48.11	11	61
Acala No. 5	385.8	145.8	37.8	1 1/16	34	55.57	5	71
Lone Star 65	425.6	149.8	35.2	1 1/16f	34	57.83	3	65
Salsbury	384.1	132.5	34.5	1 1/16f	34	51.34	7	87
Webber 49-4	295.8	91.4	30.9	1 3/16f	35½	37.56	19	81
Webber, Deltatype	359.8	114.8	31.9	1¼	36½	48.03	12	77
Sunpress	295.8	80.8	27.3	1¼	36½	34.87	20	84
Delfos 631	375.4	122.4	32.6	1 3/16	35	49.17	8	77
Delfos 6102	396.2	129.6	32.7	1⅛	34½	51.38	6	85
Express, Walcott	328.7	98.9	30.1	1⅛f	34½	39.87	18	67
Express 782	263.0	86.0	32.7	1⅛	34½	34.10	21	77
Express, Lightning	370.2	118.5	32.0	1⅛f	34½	47.17	13	87
Express 630	365.0	114.2	31.3	1⅛f	34½	45.67	15	77
D. & P. L. No. 3	333.9	101.5	30.4	1 3/16f	35½	41.84	17	82
Express 350	399.6	115.1	28.8	1⅛f	34½	46.82	14	91

The same test with Triumph omitted was planted on hill soil, consisting of Oktibbeha sand and clay loam, on April 25 and the results are reported in Table III. A cover crop of rye was plowed under about a month before planting. No other fertilizer was used and no attempt was made to control the weevil.

Each year the station tests a number of varieties, not previously tested, in comparison with other varieties long considered standard. This test was planted April 24 in six replications on slightly sandy Houston Clay and the results are given in Table IV. The only fertilizer applied was 200 pounds kainit to the acre and no attempt was made to control the weevil.

Table V reports results of the wilt variety test. As the seed bed was being prepared the soil was inoculated with wilt fungus, **fusarium,** with the assistance of the Plant Pathology Department. The soil already contained considerable wilt fungus but inoculation was made to insure more uniform infectoin. The test was planted April 25. No fertilizer or weevil poison was used.

Trice and Delfos 631 are probably the most susceptible varieties in the test and were apparently injured most. A few other varieties showed more or less injury while some showed practically none. The injury to all varieties was less than expected which was probably due to the excessive rainfall.

TABLE IV. STANDARD AND NEW VARIETIES

Variety	Pounds per Acre		Lint			Dollars per Acre	Rank	
	Seed Cotton	Lint	Per-cent-age	Length	Cts. per Lb.	Seed and Lint	in Val-ue	Bolls per Lb.
Miss. Sta. Trice	736.3	239.3	32.5	1 1/16	34	93.79	1	84
Cleveland 54	597.0	213.7	35.8	15-16	33 1/2	81.17	6	73
Cleveland Big Boll	485.7	173.4	35.7	7/8	33 1/4	65.47	18	67
Lewis Prize	611.5	226.9	37.1	7/8 f	33 1/4	85.62	4	81
Thames	503.4	184.2	36.6	3/4 f	32 1/4	67.38	16	75
Simpkins Best	504.4	193.2	38.3	3/4 f	32 1/4	70.09	13	77
Half & Half, Lee	477.4	201.9	42.3	3/4 f	32 1/4	72.00	12	74
Half & Half, Sum.	491.9	218.4	44.4	3/4 f	32 1/4	77.27	7	72
Half & Half, Davis	489.8	191.0	39.0	3/4 f	32 1/4	69.07	14	76
Half & Half, Big Boll	571.0	237.5	41.6	3/4 f	32 1/4	84.93	5	73
Miller	653.1	231.9	35.5	1 1/16	34	89.38	3	59
Miller, Lewis	696.8	239.7	34.4	1 1/16	34	92.93	2	64
Acala No. 5	513.8	192.7	37.5	1 1/16	34	73.55	11	71
Acala, Gleeck	531.4	192.9	36.3	1 1/16	34	74.03	10	74
Lone Star 65	461.8	160.2	34.7	1 1/8	34 1/2	62.81	19	67
Lone Star, Saunders	521.0	198.0	38.0	1 1/8	34 1/2	76.39	9	58
Marshall No. 1	641.7	188.0	29.3	1 1/16	35	77.14	8	89
Marshall No. 2	606.3	161.3	26.6	1 1/16 f	35 1/2	68.39	15	83
Over the Top	511.7	173.0	33.8	15-16	33 1/2	66.44	17	86

The cooperative cotton variety tests reported in Table VI were supervised by County Agents J. V. Pace, R. M. Lancaster, and F. W. Walker of Noxubee, Kemper, and Attala counties, respectively, and acknowledgement is here made for their valued services.

The Noxubee County test was planted May 7 on post oak soil near Macon. Nitrate of soda was applied at the rate of 200 pounds to the acre and no attempt was made to control the weevil.

The Kemper County test was planted May 7 on the farm of N. V. Overstreet, DeKalb. The soil was red sandy loam. The fertilizer used was 250 pounds acid phosphate and 75 pounds nitrate of soda to the acre. Hill's Mixture was applied for weevil control June 20. Leaf worms almost defoliated the plants about August 1 which probably affected yields slightly.

TABLE V. WILT VARIETY TEST

Variety	Pounds per acre		Lint			Dollars per Acre	Rank	Bolls
	Seed Cotton	Lint	Percentage	Length	Cts. per Lb.	Seed and Lint	in Value	per Lb.
Miss. Sta. Trice	612.0	193.4	31.6	1 1/16	34	76.23	7	88
Cook 588	567.0	218.3	38.5	7/8	33 1/4	81.30	5	75
Cook 307-6	591.0	219.3	37.1	7/8	33 1/4	82.21	2	77
Rhyne's Cook	561.0	206.4	36.8	7/8	33 1/4	77.50	6	88
Cleveland 54	615.0	214.6	34.9	15-16	33 1/2	81.90	3	68
Cleveland x Lewis 63	609.0	222.9	36.6	7/8 f	33 1/4	83.76	1	72
Covington Toole	504.0	177.9	35.3	13-16	32 1/4	65.52	9	86
Dixie Triumph	558.0	195.9	35.1	15-16	33 1/2	74.68	8	73
Miller	612.0	211.1	34.5	1 1/16	34	81.79	4	54
Acala No. 5	393.0	143.8	36.6	1 1/16	34	55.12	13	69
Delfos 631	465.0	152.1	32.7	1 1/16 f	35 1/2	61.82	11	69
Salsbury	450.0	149.9	33.3	1 1/8 f	34 1/2	59.22	12	80
Watson's Long Staple	471.0	166.3	35.3	1 1/8	34 1/2	64.99	10	76

Note.—Cleveland x Lewis 63 is being developed by the Station and seed is not available for distribution.

The Attala County test was planted May 7 on the farm of L. Gober, Kosciusko. The soil was clay loam hill land and no fertilizer was reported used. No attempt was made to control the weevil.

TABLE VI. COOPERATIVE COTTON VARIETY TESTS

Variety	Pounds Seed Cotton per Acre			Lint		Bolls
	County			Length	Percentage	per Lb.
	Noxubee	Kemper	Attala			
Miss. Sta. Trice	1352	521.4	883.7	1 1/16	31.4	81
Cleveland, Wan.	859	355.5	567.6	7/8	37.4	74
Cleveland 54	1019	418.7	645.0	15-16	35.0	70
Cleveland, Piedmont	1057	410.8	590.8	15-16	34.2	73
Half & Half, Lee	961	347.6	516.0	3/4 f	42.3	74
Lone Star 65	1002	434.5	687.6	1 1/8	33.9	63
Acala No. 5	928	347.6	629.5	1 1/16	36.5	69
Miller	817	347.6	580.5	1 1/16	34.6	55
Salsbury	985	371.3	541.8	1 1/8 f	33.1	78
Delfos 6102	1231	363.4	799.8	1 1/16	32.5	78

NOTE—The length, percentage, and boll size figures were taken from tests at the Central Station. They are given for general information and must be treated as approximations.

FERTILIZERS

The nitrogen sources test reported in Table VII has been conducted for three years on the same soil on the station farm. The different fertilizers were applied in all cases at the rate of 15 pounds available nitrogen to the acre based on the guaranteed analysis. This

required 100 pounds nitrate of soda, 75 of ammonium sulphate, 62.5 of calcium cyanamid, and 215 of cottonseed meal. All fertilizers, as a rule except cottonseed meal, were applied as side dressings just after hoeing. In 1921-22 the value of the increase was computed on the basis of actual lint production and the current price for lint. In 1923 the increase in seed cotton was valued at eleven cents per pound. The fertilizer costs are those actually paid for small quantities. They should be less where cooperative buying is possible.

TABLE VII. NITROGEN SOURCES TEST

Fertilizer	Pounds per Acre Increase Seed Cotton			Value in Dollars of Increase Less Cost of Fertilizer			
	1921	1922	1923	1921	1922	1923	Average
Ammonium Sulphate	154.7	91.2	208.8	5.51	20.14	20.11	15.25
Nitrate of Soda	187.0	88.0	270.3	6.78	18.56	26.48	17.27
Calcium Cyanamid	173.5	63.6	228.0	6.82	13.07	22.89	14.26
Cottonseed Meal	4.7	46.2	118.4	-3.25	6.53	7.64	3.66

TABLE VIII. NITRATE TEST—FLATWOOD SOIL

Fertilizer	Pounds per Acre Increase Seed Cotton	Dollars per Acre Less Cost of Fertilizer
100 lbs. Nitrate Before Planting	10	— 2.15
100 lbs. Nitrate After Hoeing	128	10.83
50 lbs. Nitrate Before Planting		
50 lbs. Nitrate After Hoeing	76	5.11
150 lbs. Nitrate Before Planting	100	6.13
150 lbs. Nitrate After Hoeing	113	7.56
75 lbs. Nitrate Before Planting		
75 lbs Nitrate After Hoeing	146	11.19
200 lbs. Nitrate Before Planting	104	4.94
200 lbs. Nitrate After Hoeing	84	2.74
100 lbs. Nitrate Before Planting		
100 lbs. Nitrate After Hoeing	117	6.37

The nitrate rates and dates test reported in Table VIII was conducted on the farm of Grafton Yeates (colored) about three miles southwest of Starkville. The soil is typical Flatwoods and the test was supervised by the junior author. Nitrate of soda was the source of nitrogen. The gains obtained, while somewhat inconsistent, indicate that considerable nitrogen is needed and that an application just after hoeing is safest. Subsequent trials under more nearly normal conditions will probably clarify some of the points.

The tests reported in Table IX were conducted on the farm of Mr. Cary Cocke in west central Lowndes County and were supervised by the junior author with the help of Mr. Cocke's farm foreman. Nitrate of soda was the source of the nitrogen. The acid phosphate and kainit were applied before planting.

The nitrate results indicate very clearly that an aplication just after hoeing is the more profitable. A more normal season may reverse these results. Results from the use of acid phosphate and kainit are inconsistent besides being largely negative and need further trials before conclusions are drawn.

TABLE IX. COOPERATIVE FERTILIZER TESTS

Fertilizer Used	Increase in Pounds Seed Cotton per Acre		Value Increase Less Cost of Fertilizer	
	Black Soil	Post Oak Soil	Black Soil	Post Oak Soil
100 lbs. Nitrate Before Planting	39	—95	$1.04	$—13.70
100 lbs. Nitrate After Hoeing	180	106	16.55	7.41
150 lbs. Nitrate Before Planting	81	63	4.04	2.06
150 lbs. Nitrate After Hoeing	251	193	22.74	16.36
200 lbs. Nitrate Before Planting	126	82	7.56	2.52
200 lbs. Nitrate After Hoeing	349	194	32.09	14.84
100 lbs. Acid Phosphate	0	—75	—1.10	—9.35
200 lbs. Acid Phosphate	18	36	—.22	1.76
300 lbs. Acid Phosphate	—8	—31	—4.18	—6.71
100 lbs. Kainit	—58	147	—7.30	15.25
200 lbs. Kainit	—38	—26	—6.03	—4.71
300 lbs. Kainit	—17	26	—4.64	0.09

BOLL WEEVIL POISONING

The boll weevil control work was carried on in cooperation with Mr. W. H. Sudduth on his plantation north of Starkville, Mississippi. Only one method of control was used, the one that is sponsored by the Government, commonly known as the Coad Method.

The purpose of the work was to determine the efficiency of this one method of control in this section of the state. It was not the purpose to alter the method, but to follow the rules as nearly as possible. In practice, however, the plan was not strictly adhered to due to the weather and road conditions. But it was as closely followed as could be expected in general farm practice.

The interval of poisoning on the average was seven or eight days, taking the season as a whole. Only one application was washed off by rain directly after applying, but it so happened that the rains came just at the time to postpone the poisoning a few days. Saturdays and Sundays helped in broadening the periods of application. Colored labor knows little difference between those two days. To offset this condition a much heavier application of poison was made than the Coad Method calls for. The heavier application was necessitated also by the rank growth of cotton. The Coad Method calls for five to seven pounds per application at intervals of four days.

Due to the delay in the shipment of poison, work was not begun until July 10, at which time the cotton was quite rank and the weevil infestation ran from one to fifty percent.

The plots were selected from various fields of the large plantation so as to get as much variety in soils as possible, and to get cotton which would most naturally have the highest infestation. Fourteen plots 18 rows wide and about 70 yards long were selected for poisoning and an equal number adjacent to these and of the same size were selected as checks. The plots were made 18 rows wide so that the middle six rows might be used in getting the weights and leave six rows on

TABLE X. RESULTS OF BOLL WEEVIL POISONING WORK

Plot No.	Pounds per Acre			Per Cent	Number of
	Poisoned	Unpoisoned	Gain	Gain	Applications
1	1284	482	802	166	6
2	1050	482	568	118	6
3	1252	690	562	81	6
4	1440	400	1040	260	6
5	1198	716	482	63	7
6	1296	522	774	148	7
7	1344	684	660	96	5
8	1310	796	514	65	5
9	1532	600	932	155	5
10	1354	596	753	126	6
11	1222	436	786	180	6
12	1164	408	756	185	5
13	944	566	378	67	6
14	288	410	—122	—30	6

Total Gain on 14 Acres	8890 Pounds
Average Gain Per Acre	635 Pounds
Average Yield on Checks	556 Pounds
Per cent Gain for Poisoned Plots	114.2
Rate of Application, Approximately	12 Pounds
Average Number of Applications	6
Total Poison Used per Acre	72 Pounds
Cost of Poison per Pound	20c
Total Cost of Poison per Acre	$14.40
Value of 635 lbs. Seed Cotton @ 11c	69.85
Net Gain (Above Cost of Poison)	55.45

both sides that had been poisoned which might serve as a battle ground against the migrating weevils. Weights on each of the 18 rows on all poisoned plots were kept separate, Number One row always being on the east side of the plot. A graph constructed, based on the yields of each row, seems to indicate very distinctly that six rows were enough in which to halt the inroad of the weevils.

The tabulated results of the poisoning as given in the table are self-explanatory and hence need no lengthy explanation further than to say that the abnormal gains in plots 4 and 9 are due to soil conditions to a good extent. The checks to these plots proved to be on lower ground than the poisoned plots, thus allowing the excessive rains to do greater damage to the checks than to the poisoned plots. The same conditions are to be found in plots 3 and 7, but to a much

less degree. But in plot 14 the reverse is true. Unfortunately the poisoned plot was located on a sand bar and the cotton almost died from rust. That is the cause for its showing a loss rather than a gain. In making the calculations, however, it was used the same as the others feeling that it would no more than offset the abnormal gain of plot 4 alone.

It will be noted that the average net gain of $55.45 per acre is a bit flattering. It will be understood, however, that the season was quite favorable for poisoning, in so far as moisture conditions are concerned, which will no doubt make it very difficult to duplicate these results another season. One of the draw-backs to the dusting method of weevil control at this Station in the past has been the lack of dew at poisoning time. That was by no means the case this year as it was an exceedingly wet season.

Most of the poisoning was done with the "mule back" or saddle type dust gun which made it possible to get into the field immediately after rains. This is a great asset in the poisoning game. If the cart duster or the hand dust gun had been the only reliance with the weather conditions as they were during this season, the results might have been negligible, or nearly so, for neither of these guns will prove satisfactory in a muddy field. The hand gun had to be used, however, while the saddle gun was in the repair shop, and that was far too often. Out of three new hand guns only one would deliver a satisfactory dust cloud. In addition to this fact, it was almost beyond human endurance to turn the machines a sufficient time to cover even a small acreage. This corresponds to previous experience with hand guns.

The outstanding drawback to this method of weevil control is the lack of satisfactory machinery for applying the poison. With that fact taken into consideration one may expect fair results from the use of this method provided the cotton will make a half bale or more per acre without weevil damage.

It will be found by consulting the table that it took 131 pounds of seed cotton per acre, selling at current prices, to pay for the poison alone for the acre. It is true that the applications were somewhat excessive. Nine or ten pounds very likely would have answered the purpose equally well but it is doubtful whether it can be reduced much below that under adverse conditions and still be safe. Not until substantial machines which will deliver a uniform quantity are made will it be possible to reduce the rate of application to the minimum under field practice. The dust guns do not deliver a uniform quantity of dust. One might adjust his gun on one row to five or six pounds and on the next row or two he is just as likely to deliver three or four pounds, or less, or possibly seven or eight pounds, as he is to deliver the five or six pounds. In two-row machines the two nozzles may be set to deliver equal amounts going to one end and before one gets over two rows one nozzle may be delivering twice or three times as much as the other. Under these conditions of machinery imperfections, how is one going to reduce his rate of application to the minimum and yet be certain there is enough on every row?

SEED SOURCES

Acala No. 5	Nunn Seed Farms, Porter, Okla.
Acala No. 5, Gleeck	L. E. Gleeck, Box 334, Memphis, Tenn.
Cleveland Big Boll	J. R. Cleveland, Stratton, Miss.
Cleveland, Piedmont	Piedmont Pedigreed Seed Farms, Commerce, Ga.
Cleveland, Wannamaker	Model Seed Farms, St. Matthews, S. C.
Cleveland 54	Miss. Exp. Sta., A. & M. College, Miss.
Cook, Rhyne	Rhyne Bros., Benton, Ala.
Cook 307-6	Ala. Exp. Sta., Auburn, Ala.
Cook 588	Robert Hudson, Auburn Ala.
Covington Toole	W. F. Covington, Montgomery, Ala.
Delfos 631	Delta Branch Exp. Sta. Stoneville, Miss.
Delfos 6102	Delta Branch Exp. Sta. Stoneville, Miss.
Dixie x Triumph	L. O. Watson, Florence, S. C.
D. & P. L. No. 3	Delta and Pine Land Co., Scott, Miss.
Express, Lightning	Pedigreed Seed Co., Hartsville, S. C.
Express, Walcott	C. D. Walcott & Son, Hollandale, Miss.
Express 350	Stoneville Pedigreed Seed Co., Stoneville, Miss.
Express 630	Delta Branch Exp. Sta. Stoneville, Miss.
Express 782	Delta Branch Exp. Sta. Stoneville, Miss.
Half & Half, Big Boll	N. C. Cleveland, Stratton, Miss.
Half and Half, Davis	J. N. Davis, Hillsboro, Ala.
Half and Half, Lee	Mark B. Lee, Corinth, Miss.
Half and Half, Sum.	B. F. Summerour, Norcross, Ga.
Lewis Prize	W. B. F. Lewis, Warnerton, La.
Lone Star, Saunders	D. A. Saunders, Greenville, Texas.
Lone Star 65	Miss. Exp. Sta., A. & M. College, Miss.
Marshall No. 1	R. M. Bridgforth, Pickens, Miss.
Marshall No. 2	R. M. Bridgforth, Pickens, Miss.
Miller	Miss. Exp. Sta., A. & M. College, Miss.
Miller, Lewis	J. W. Lewis, Woodland, Miss.
Over the Top	L. E. Gleeck, Box 334, Memphis, Tenn.
Salsbury	Delta and Pine Land Co., Scott, Miss.
Simpkins Best	W. A. Simpkins, Raleigh, N. C.
Sunpres	Delta Branch Exp. Sta. Stoneville, Miss.
Thames	Jake Thames, Decatur, Miss.
Trice, Miss. Sta.	Miss. Exp. Sta., A. & M. College, Miss.
Triumph	Stark Willis, Graysport, Miss.
Webber, Deltatype	Pedigreed Seed Co., Hartsville, S. C.
Webber 49-4	Pedigreed Seed Co., Hartsville, S. C.
Watson's Long Staple	L. O. Watson, Florence, S. C.

Note.—The station's Supply of Trice and Lone Star seed is exhausted for the coming season.

Bulletin No. 220 December 1923

REPORT

from

Holly Springs Branch Experiment Station for 1923

By C. T. AMES

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

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Miss Fannie Page, Stenographer.
Miss Mary Alice Lanier, Addressograph Operator.
D. W. McIlwain, Superintendent of Farm.
D. Maxwell, Foreman and Herdsman.
B. V. Evans, Farm Foreman, South Miss. Branch Station.
J. C. Ryan, Farm Foreman, Holly Springs Branch Station.
J. C. Peyton, Farm Foreman, Raymond Branch Station.
K. C. Livingston, Farm Foreman, Delta Branch Station.
F. O. Cork, B. Sc., Superintendent, Farm Management Vocational Project.
H. B. Brown, Ph. D., Collaborator.
E. C. Ewing, M. Mc., Collaborator.

*In co-operation, Bureau of Animal Industry, U. S. Department of Agriculture.

Holly Springs Branch Experiment Station—1923

This bulletin contains a greater part of this year's work. There are some projects incomplete which cannot be reported on at this time. In our farming experience we have never seen weather conditions as they were this year. We have seen prolonged rainy seasons at various times of the year, but we have never seen rain begin in April and continue until September with only a few days' intermission between rains. According to the United States Government Report, 1923 marks the shortest cotton crop in Mississippi for the past fifty years.

Weather conditions at Holly Springs, Miss., 1923:

Months—	Rainy Days	Cloudy and Rainy Days	Total Rainfall Each Month	Total Rainfall for Six Months
April	13	14	9.09	---
May	16	17	11.28	---
June	13	14	6.75	---
July	12	16	4.60	---
August	13	18	3.84	---
First 10 days in Sept.	7	8	2.36	---
Total	---	---	---	37.82

Soil improvement has had the first place with us, recognizing that a fertile soil is the basis of all successful agriculture. We see to it that every acre of our cultivated lands grows a legume of some kind, either summer or winter and in some instances both.

Special attention has been given to cotton, corn, and sweet potato variety studies and spacing tests. Boll weevil poisoning has had every attention, with the assistance of the State Plant Board and every employee of this Station. Cultural methods with cotton and corn, and fertilizer studies with cotton have had a prominent place in the year's work. Co-operative fertilizer tests under the supervision of County Agents and good farmers have given good results.

Variety tests with alfalfa, vetch, grasses, and clovers, forage crops, permanent pastures, crop rotations and the use of lime have had attention.

Erosion—Over the State more attention to soil washing is being paid now than in the past. Soil washing should have first attention even before the growing of legumes or the use of farm manures. The importance of this work has never been fully realized and until the surface water is properly controlled on rolling hill lands there is but little hope of increasing soil fertility. How can land increase in fertility that washes with every heavy rain? County Agents are giving more attention to terracing. The Federal

Farm Loan Bank is requiring all cultivated rolling lands to be terraced before government loans will be made on such lands. The broad shallow terrace with a slight fall has given good results. Terrace the best acre on the farm first, and then the next best acre, and so on until the farm is terraced. Where terracing is done in time the cost is but little. Labor is the principal cost and even where outside labor is employed, the cost of constructing terraces on one acre of land will be the cost of one laborer per day, plus the cost of the teams. These teams are doing but little at the season when terracing should be done.

COTTON

For the next few years at least cotton will of necessity be one of Mississippi's chief money crops; and under existing conditions, should be. The prospects for prices are good and if every farm will grow at least the foods and feed required for the farm the price for cotton will remain good for some time to come. Two outstanding things confront the growers of cotton another year. These are fertilizers, and the use of poison to control the boll weevil. The necessity of using both fertilizer and poison and the proper use of each will to a great extent measure the success or failure in profitably growing cotton in the future. While variety and cultural methods will have their effect, the most important factors will be fertilizers and poison.

Preparation and Cultivation—On account of soil washing during the heavy rains of the winter on hill lands, it is advisable to leave as much vegetable matter on the land as possible for protection. Sod lands should be turned in the fall or winter and left rough. Valley lands may be prepared for cotton during fall or winter if the water is properly controlled on the land. Where such is not the case but little will be gained. On rolling land unprotected by terraces and where every row has more fall than it should have, soil washing will be increased by fall plowing. Only two ways shall be given to prepare land and fertilize same for cotton. Where two furrows are thrown together or listed it is a common practice to apply the fertilizer on this list by hand, or in the list with a fertilizer distributor. After this the middles are thrown out and the land after harrowing is ready for planting. The other method is to prepare the land in rows, open the rows and distribute the fertilizer, covering by the use of a harrow. If possible apply the fertilizer a week or ten days before planting. We have very often found it necessary to apply the fertilizer just ahead of the planter.

Seed Bed—A well prepared firm seed bed is ideal for seed of any kind. If the land can be prepared and fertilized far enough ahead to be settled by rain, then harrowed and planted, the condition would be ideal. About cotton planting time rains are usually frequent and but little attention is given the subject. In case of dry weather use the roller after planting.

Width of Row—For fertile valley lands make three and one-half foot rows. For thin upland, three foot rows are sufficient.

Time of Planting—Cotton planting time in this latitude is after April the twenty-fifth and if possible should be completed before May 10th. It appears that the time changes going south from this place at the rate of

one day earlier for each additional twenty miles. In other words, the time for planting along the Southern Railroad from Greenville to Columbus, one hundred miles south of here, is about April 20th, and so on. When cotton is planted earlier than the date given, one of two things usually occurs: the land has to be planted over or a poor stand is secured which usually winds up with a much later planting. Early planting is desired; also a perfect stand is desired. By medium early planting a good stand can be secured. The easiest way for Mississippi to increase her cotton crop from twenty-five to fifty per cent on many farms in the State without cost is to get a stand of cotton. Four or five years ago the above would have applied to most of the cotton grown in the State.

A Stand of Cotton—On hill land a stand of cotton is from three to five stalks in bunches about twelve inches apart. On valley or fertile hill land, rows should be three and one-half feet wide and two to four stalks in bunches to every foot. Cotton seed should be planted very shallow and on medium elevated rows. Use not less than one and one-half bushels of seed per acre. It is the common custom to run the planters twice down the same row. The first trip will plant the seed deep and the second trip will plant shallow. This method will increase chances for a stand. If the seed have been delinted and the inferior seed removed, a good stand can be secured with less seed.

Fertilizers—See recommendations under fertilizer experiments.

Varieties—See recommendations under variety studies.

Cultivation—Cultivation should begin as soon as the plants are established sufficient not to be injured in cultivation. Thin as soon as possible and give frequent shallow cultivations.

Early Poisoning—Calcium arsenate applied in the bud of the cotton just as the squares begin to show will kill the weevil. Either the sweet poison or the dust form will do the work. A second application ten days later will kill more weevils. These two applications will probably control the weevil on thin hill and assisted by dry weather. After there is a ten per cent infestation use the calcium arsenate dust as recommended by Mr. Coad. Make frequent infestation counts.

A Progress Report of our boll weevil work for this year can be had from the Main Station, at the A. & M. College, Mississippi.

VARIETY TEST WITH COTTON—1923

Two tests were made, one on hill and one on valley land.

The seasons were unfavorable, causing late planting and some replanting. The dates of planting were May 7 and May 8, 1923. The valley land test was on first-class valley land where vetch has been grown for years. This land is infested with coco grass and between the rains and coco, only a fair stand was secured. With a few exceptions, the stand of one variety was about as good as the stand of another.

The hill land test was on Brown Loam table land that would make about three-fourths of a bale of cotton a normal season without boll weevil.

Tables No. 1 and No. 2 give the results of these variety tests.

Table No. 1.—VALLEY VARIETY TEST, 1923

No.	VARIETY TEST	Total Yield Seed Cotton Per Acre	Lint Per Cent.	Pounds of Lint Per Acre	Length of Lint	Value of Lint Per Pound	Value of Lint	Pounds of Seed Per Acre	Value of Seed at $50 Per Ton	Total Money Value Per Acre	Rank in Money Value
1.	Miss. Station Trice	1360.0	30.0	408.0	1-1/16	34	$138.72	952.0	$23.80	$162.52	3
2.	Wann-Cleveland	882.5	36.8	324.8	7/8	32¾	106.37	557.7	13.94	120.31	20
3.	Piedmont-Cleveland	1075.0	33.0	354.8	15/16	33½	118.84	720.2	17.96	136.80	10
4.	Cleveland-54	1187.5	35.4	420.4	15/16	33½	140.83	767.1	19.18	160.01	5
5.	Half & Half	962.5	37.9	364.8	3/4	32¼	117.65	597.7	14.94	132.59	11
6.	Cooks-588	952.5	36.5	347.7	7/8	33¼	115.61	604.8	15.12	130.73	12
7.	Triumph (Willis)	1262.5	32.9	415.4	15/16	33½	139.16	847.1	21.18	160.34	4
8.	Miller	972.5	32.6	317.0	1-1/16	34	107.78	655.5	16.39	124.17	16
9.	Acala No. 5	890.0	36.4	324.0	1-1/16	34	110.16	566.0	14.15	124.31	15
10.	Lone Star-65	1375.0	33.5	460.6	1-1/16	34	156.60	914.4	22.86	179.46	1
11.	Salsbury	962.5	32.5	312.8	1-1/16	34	106.35	649.7	16.24	122.59	18
12.	Webber 49-4	820.0	30.4	249.3	1-1/4	37	92.24	570.7	14.27	106.51	24
13.	Webber Delta Type	962.5	29.8	286.8	1-3/16	35½	101.81	675.7	16.89	118.70	21
14.	Sunpress	1032.5	27.4	282.9	1-1/4	37	104.67	749.6	18.74	123.41	17
15.	Delfos 631	1115.0	32.3	360.1	1-3/16	35½	127.84	754.9	18.87	146.71	7
16.	Delfos 6102	1297.5	31.5	408.7	1-3/16	35	143.05	888.8	22.22	165.27	2
17.	Express-Walcott	947.5	29.4	278.6	1-3/16	35	97.51	668.9	16.72	114.23	22
18.	Express 782	995.0	32.2	320.4	1-3/16	35	112.14	674.6	16.87	129.01	13
19.	Express-Lightning	1160.0	30.4	352.6	1-3/16	35	123.41	807.4	20.19	143.60	9
20.	Express 630	1015.0	30.0	304.5	1-3/16	35	106.58	710.5	17.76	124.34	14
21.	D. & P. L. No. 3	795.0	29.9	237.7	1-1/4	36½	86.76	557.3	13.93	100.69	25
22.	Express 350	952.5	27.4	261.0	1-3/16	35	91.35	691.5	17.29	108.64	23
23.	Harrison's Pet	992.5	31.4	311.6	7/8	33¼	103.61	680.9	17.02	120.63	19
24.	Mahon's Imp. ½ & ½	992.5	41.9	415.9	7/8	33¼	138.29	576.6	14.42	152.71	6
25.	Lone Star 79	1175.0	30.2	354.9	1-3/16	35	124.22	820.1	20.50	144.72	8

Table No. 2.—HILL VARIETY TEST, 1923

No.	VARIETY USED	Total Yield Seed Cotton Per Acre	Lint Per Cent.	Pounds of Lint Per Acre	Length of Lint	Value of Lint Per Pound	Value of Lint	Pounds of Seed Per Acre	Value of Seed at $50 Per Ton	Total Money Value Per Acre	Rank in Money Value
1.	Miss. Station Trice	755.7	33.9	256.2	1- F	33¾	$86.47	499.5	$12.49	$ 98.96	3
2.	Wann-Cleveland	438.5	38.9	170.6	7/8	32¾	55.87	267.9	6.70	62.57	22
3.	Piedmont	622.0	36.0	223.9	7/8	33¼	74.45	398.1	9.95	84.40	13
4.	Cleveland 54	503.8	37.5	188.9	7/8	33¼	62.81	314.9	7.87	70.68	17
5.	Half & Half	578.5	41.6	240.7	3/4	32¼	77.63	337.8	8.45	86.08	12
6.	Cook's 588	631.3	40.0	252.5	7/8	32¾	82.69	378.8	9.47	92.16	8
7.	Triumph (Willis)	765.1	35.3	270.1	7/8	33¼	89.81	495.0	12.38	102.19	2
8.	Miller	547.4	37.0	202.5	1- F	33¾	68.34	344.9	8.62	76.96	15
9.	Acala No. 5	671.8	38.9	261.3	1- F	33¾	88.19	410.5	10.26	98.45	4
10.	Lone Star 65	668.7	34.3	299.4	1-1/16	34	78.00	439.3	10.98	88.98	11
11.	Salsbury	482.1	35.6	171.6	1-1/16	34	58.34	310.5	7.76	66.10	19
12.	Webber 49-4	317.2	32.5	103.1	1-3/16	35	36.09	214.1	5.35	41.44	25
13.	Webber-Delta Type	438.5	35.5	155.7	1-3/16	35	54.50	282.8	7.07	61.57	23
14.	Sunpress	572.2	29.9	171.1	1 3/16F	35½	60.74	401.1	10.03	70.77	16
15.	Delfos 631	690.4	35.0	241.6	1-3/16	35	84.56	448.8	11.22	95.78	6
16.	Delfos 6102	659.3	34.9	230.1	1-1/8	34½	79.38	429.2	10.73	90.11	9
17.	Express-Walcott	674.9	33.5	226.1	1-1/8F	34½	78.01	448.8	11.22	89.23	10
18.	Express 782	572.2	35.2	201.4	1-1/8F	34½	69.48	370.8	9.27	78.75	14
19.	Express-Lightning	842.8	32.9	277.3	1-1/8F	34½	95.67	565.5	14.14	109.81	1
20.	Express 630	737.1	32.5	239.6	1-1/8F	34½	82.66	497.5	12.44	95.10	7
21.	D. & P. L. No. 3	522.5	32.7	170.9	1-3/16	35	59.82	351.6	8.79	68.61	18
22.	Express 350	506.9	31.2	158.2	1-1/8	34½	54.58	348.7	8.72	63.30	21
23.	Harrison's Pet	451.0	34.6	156.0	7/8S	32¾	51.09	295.0	7.38	58.47	24
24.	Mahon's Imp. ½ & ½	457.2	40.1	183.3	3/4F	32¼	59.11	273.9	6.85	65.96	20
25.	Lone Star 79	737.1	33.1	244.0	1-1/8	34½	84.18	493.1	12.33	96.51	5

Varieties—This is the second year since the war that staple cotton and short cotton has brought within a few cents of the same price. How long these conditions will exist we are unable to answer. The closer the prices of long and short staple are to each other, the more difficult it is to make selections especially for hill land varieties, as so much improvement has been made in the staple varieties. In these variety tests it will be seen that Lightning Express, pulling 1⅛ inches in staple, gave the highest money value. It is evident that the variety did better on hill land this year than on valley land. As a rule it is better to grow short staple varieties of cotton on thin upland than the staple varieties. Stark Willis' Triumph, ⅞ inches in staple came second, Mississippi Station Trice third, etc. Unquestionably the early big boll varieties should be added to this list, such as Piedmont Cleveland, Cleveland Big Boll and Cleveland 54.

In the valley land test, Lone Star-11-65 gave the highest money value. This is a very promising variety and when seed of this variety can be had in sufficient quantities. it will rank high as a bender cotton. Delfos-6102 and 631, Mississippi Station Trice, Stark Willis' Triumph, Cleveland 54 and Cleveland Big Boll all do well on the richer lands.

FERTILIZER TEST WITH COTTON—1923

Soil—Brown Loam Valley Land.

Variety of Cotton—Delfos 6102. A good stand was secured.

Date of Planting—April 27, 1923.

Size of Plats—1/43 of an acre each.

TABLE No. 3.

Lbs. per Acre	Fertilizer Used—	SERIES 1.		SERIES 2.		Av. Value of Seed Cotton per A. at 10c per Lb. for Staple Cotton
		Yield Seed Cotton per Acre	Increase Over Checks per Acre	Yield Seed Cotton per Acre	Increase Over Checks per Acre	
200	Acid Phosphate	.....	.....	1616.2	95.0	$161.62
	Check	.....	.....	1521.2	.....	152.12
400	Tenn. Phosphate Rock	.....	.....	1841.10	319.8	184.10
400	Florida Soft Rock	.....	.....	1780.5	60.5	178.05
	Check	.....	.....	1720.0	.....	172.00
100	Nitrate Soda	.....	.....	1650.8	319.8	165.08
	Check	.....	.....	1331.0	.....	133.10
100	Cyanamid	.....	.....	1547.1	86.4	154.71
	Check	.....	.....	1460.7	.....	146.07
75	Sulphate Ammonia	.....	.....	1581.7	121.0	158.17
50	Nitrate Ammonia	1659.5	172.9	1408.8	86.4	153.42
	Check	1486.6		1322.4	.....	140.45
200	Dried Blood	1771.8	285.2	.....	.....	177.18
25 37½	Nitrate Ammonia and Sulphate Ammonia	.....	.....	1365.6	43.2	136.56

TABLE No. 3—(Continued)

Lbs. per Acre	Fertilizer Used—	SERIES 1		SERIES 2.		Av. Value of Seed Cotton per A. at 10c per Lb. for Staple Cotton
		Yield Seed Cotton per Acre	Increase Over Checks per Acre	Yield Seed Cotton per Acre	Increase Over Checks per Acre	
	Check	1841.0	.....	1106.3	.....	147.37
50	Nitrate Soda and					
125	Cottonseed Meal	1884.2	43.2	1279.2	172.9	158.17
50	Nitrate Soda and					
100	Tankage	1478.0	17.3	.....	.....	147.80
	Check	1460.7	.....	864.3	.....	116.25
	Soak Seed in Ni. Soda Sol. and					
50	After first working and					
50	On July 1st	.....	.....	1287.8	423.5	128.78
250	Cottonseed Meal and					
200	Acid Phosphate	1624.9	146.9	.....	.....	162.49
	Check	1478.0	.....	1391.5	.....	143.48
100	Nitrate Soda and					
200	Acid Phosphate	1841.0	363.0	1953.3	561.8	189.72
	Check	.....	.....	1080.4	.....	108.04
200	Tankage and					
200	Acid Phosphate	1443.4	146.9	1235.9	155.5	133.97
	Check	1296.5	.....	1106.3	.....	120.14
50	Nitrate Sida and					
37½	Sulphate Ammonia	.....	.....	1244.6	138.3	124.46
75	Cyanamid and					
200	Acid Phosphate	.....	.....	1789.1	250.6	178.91
	Check	.....	.....	1538.5	.....	153.85
75	Sulphate Ammonia and					
200	Acid Phosphate	.....	.....	1668.1	129.6	166.81
200	Dried Blood and					
200	Acid Phosphate	1979.2	518.5	.....	.....	197.92
	Check	1460.7	.....	.....	.....	146.07
100	Nitrate Soda and					
400	Tenn. Phosphate Rock	1616.2	17.2	1305.1	293.9	146.07
100	Nitrate Soda and					
400	Florida Soft Rock	2057.0	458.0	1279.2	268.0	166.81
	Check	1599.0	.....	1011.2	.....	130.51
100	Nitrate Soda and					
200	Duplex Phosphate	1841.0	458.1	1642.2	337.1	174.16
	Check	1382.9	.....	1305.1	.....	134.40
100	Nitrate Soda and					
200	Acid Phosphate and					
50	Kainit	2100.2	717.3	1642.2	561.8	187.12
	Check	1382.9	.....	1080.4	.....	123.17

Remarks—The lower end of these plats was ruined by continued rains, thereby destroying the results in part of Series No. 1. A complete fertilizer consisting of 200 pounds of acid phosphate, 100 pounds of nitrate of soda, and 50 pounds of kainit gave the highest yields in both series. The

Table No. 5—CO-OPERATIVE FERTILIZER TESTS—1923

RESULTS ON ACRE BASIS

Plat No.	Fertilizer Used—(Pounds)	GRENADA		BOONE-VILLE		OLIVE BRANCH		EUDORA	
		Av. Yield 2 Series	Val. Seed Cotton at 11c	Av. Yield 2 Series	Val. Seed Cotton at 11c	Av. Yield 2 Series	Val. Seed Cotton at 11c	Av. Yield 2 Series	Val. Seed Cotton at 11c
1.	100 Nit. So.	471	$51.81	350	$38.50	919	$101.09	390	$42.90
2.	200 Acid Phos.	325	35.75	517	56.87	859	94.49	326	35.86
3.	Check	318	34.98	251	27.61	802	88.22	217	23.87
4.	200 Acid Phos. 100 Nit. So. 100 Kainit	487	53.57	657	72.27	1071	117.81	480	52.80
5.	200 Acid Phos. 100 Nit. So.	512	56.32	656	72.16	882	97.02	480	52.80
6.	Check	314	34.54	254	27.94	822	90.42	188	20.68
7.	150 Acid Phos. 100 Nit. So. 75 Kainit	565	62.15	660	72.60	775	85.25	508	55.88
8.	150 Acid Phos. 100 Nit. So. 100 Kainit	621	68.31	750	82.50	875	96.25	526	57.86
9.	Check	368	40.48	299	32.89	775	85.25	263	28.93
10.	250 Acid Phos. 100 Nit. So.	650	71.50	657	72.27	763	83.93	517	56.87
11.	250 Acid Phos. 100 Nit. So. 100 Kainit	586	64.46	583	64.13	788	86.68	571	62.81
12.	Check	332	36.52	147	16.17	820	90.20	272	29.92
13.	300 Acid Phos. 150 Nit. So.	586	64.46	572	62.92	1045	114.95	598	65.78
14.	300 Acid Phos. 150 Nit. So. 100 Kainit	574	63.14	593	65.23	1085	119.35	635	69.85
15.	Check	293	32.23	167	18.37	728	80.08	272	29.92
16.	300 Acid Phos. 200 Nit. So.	642	70.62	537	59.07	919	101.09	680	74.80
17.	300 Acid Phos. 200 Nit. So. 100 Kainit	700	77.00	667	73.37	1008	110.88	680	74.80

Remarks—In the plats at Grenada it will be seen that plat No. 17 has given $43.77 profit over the check plat, plat No. 16, $37.39 and plat No. 10. $31.02.

In the plats at Boonville, plat No. 17 gave a profit of $55.00 over the check, and plat No. 8, $49.61. The fertilizer for the last plat is the most economical quantity, we believe, for that locality.

In the plats at Olive Branch, plat No. 14 gave a profit over the check plat of $39.27, No. 17 a profit of $30.80, and No. 4 a profit of $29.59. This set of plats had an application of cow manure the year before and this could account for the irregularity in the results as can be seen.

In the plats at Eudora, plats Nos. 16 and 17 gave a profit over the check of $44.88, No. 14 gave a profit of $39.93 and No. 7 a profit of $35.20.

It should be remembered that this is only one year's results and that these results should not be considered conclusive.

Conclusions—There is no marked difference as to the fertilizer requirements in these several sections. The outstanding fact is that both nitrogen and phosphorous are deficient and potash to some extent, and that a moderate amount of a complete fertilizer rich in nitrogen increases the yield of cotton from 200 to 400 per cent any year.

Taking into consideration these results and results for the past four years at this Station, we believe from 50 to 100 pounds of kainit or potash in other forms, per acre, added to our former recommendations is advisable. For average conditions 200 pounds acid phosphate, 100 pounds nitrate of soda and 100 pounds of kainit mixed, per acre or 400 pounds of a mixed fertilizer analyzing 8% phosphoric acid, 4% nitrogen and 3% potash (8-4-3). Where good farming is to be done, the addition of from 50 to 100 pounds of nitrate of soda added to the above as a side dressing will be found profitable. On lands to be planted in cotton after lespedeza or other leguminous crops that have been turned under or farm manures used, the amount of nitrogen may be reduced to about half, but at least the fertilizer recommended should be used.

COTTON SPACING TEST—1923

Soil—Brown Loam Table Land.

Size of Plats—1/15.56 of an acre, planted to Wannamaker Cleveland Cotton.

Date of Planting—May 8 and replanted skips May 28, 1923.

TABLE No. 6.

Series 1—Poisoned with calcium arsenate dust.

Plants Per Hill	Inches Between Hills	SERIES 1—Poisoned			SERIES 2—Unpoisoned		
		Pounds Seed Cotton		Acre Val. Seed Cotton at 10c per Lb.	Pounds Seed Cotton		Acre Val. Seed Cotton at 10c per Lb.
		Plat Yield	Acre Yield		Plat Yield	Acre Yield	
Unthinned	....	47.2	734.4	73.44	26.0	404.6	40.46
1	6	45.8	712.7	71.27	25.9	403.0	40.30
2	12	40.1	624.0	62.40	26.3	409.2	40.92
1	12	37.8	588.2	58.82	21.3	331.4	33.14
1	18	29.5	458.9	45.89	20.6	320.5	32.05
1	24	31.0	482.4	48.24	16.5	256.7	25.67

Remarks—A poor stand was secured and while replanted by hand these replants amounted to but little. The late planting, excessive rains and labor shortage about destroyed this test except as a poisoning test. Our valley land test was destroyed for the reasons given above. In this test the unthinned cotton has given the best yield; we do not think it is practical to grow cotton unthinned. On hill land, three to four stalks in a bunch every foot is not far from proper spacing; on valley land from two to three stalks every foot. This year many farmers have charged up the work of the boll weevil to close spacing, that is to say, they have made but little cotton and some of them say close spacing is the cause.

The land on which the 24-inch space cotton was grown was in velvet beans during 1920 and 1921. This cotton grew almost double the size stalk this year which will in all probability account for the yield given.

CORN

The yield of corn on the Station this year will average more than fifty bushels per acre. Practically all corn grown on the Station is after vetch or some winter legume. As a rule, where the land is thin, early planting of corn, say around the latter part of April, gives the best results. The seasons are usually more favorable about the time the corn begins to fruit, than is the case where later plantings are made. Thin land is a poor place to try to grow corn. If our corn and bean test gives anywhere near what could be expected an average year and we believe they do, by all means grow beans in all planting of corn.

Where such a method can be practiced, break the land broadcast, harrow and plant. If the soil is poorly drained, bed in seven-foot rows, harrow and plant two rows to a bed.

Fertilizers—Corn responds as readily to the use of fertilizers as does other crops. As corn blooms only once unfavorable weather at that season may cause the fertilizer to prove unprofitable. When possible, plant only fertile land to corn. Apply a mixture of 150 pounds acid phosphate and 100 pounds of nitrate of soda per acre in the row before planting. If the land has been fertilized freely with acid phosphate for several years prior

to corn planting, only nitrate of soda need be used. We would not think of growing corn without the use of fertilizer even though the water supply does frequently control the yield.

Planting and Cultivation—Corn should be planted very shallow in the spring. We prefer wasting seed corn in order to insure a good stand. On average land, one stalk of corn every thirty inches is about the right distance. As the land increases or decreases in fertility the distance should vary. The more fertile the land the closer the corn can be grown. The usual mistake is to grow corn too thick and cotton too thin. Four or five cultivations are usually sufficient, especially on late plantings. A Perry cultivator run two or three inches deep gives very satisfactory results. Any plow or cultivator that will leave a comparatively smooth surface and not plow deeper than three inches is all right for corn culture. Where deep cultivation is practiced from the beginning it has proven satisfactory. Run the cultivator about the same depth at each cultivation.

VARIETY CORN TEST—1923

Soil—Valley Land.

Plats—One row each planted in checks, repeated six times. Rows or checks 3½ feet apart, with two stalks to each hill.

Date of Planting—June 25, 1923.

Fertilizer Used—200 pounds acid phosphate and 100 pounds nitrate of soda.

TABLE No. 7.

No.	Variety Used—	Yield in Bu. Shelled Corn Per Acre	Yield in Lbs. Ear Corn Per Plat	Per Cent of Grain	Size of Plats On Acre Basis	Rank
1.	Williamson	66.62	323	75.0	1/15.40	13
2.	Biggs Seven Ear	66.97	348	75.0	14.37	12
3.	Whatley	69.57	355	72.2	15.20	10
4.	Mosby—Station	64.73	337	76.4	14.08	14
5.	Mosby—Delta	67.61	341	77.1	14.40	11
6.	Cocke's Prolific—Station	72.51	372	77.8	14.03	6
7.	Cocke's Prolific—Delta	72.81	361	74.3	15.20	4
8.	Davis Prolific	61.52	318	73.6	14.72	18
9.	Hastings	72.80	367	76.4	14.54	5
10.	Vardaman	69.73	361	77.1	14.03	9
11.	Marlboro	63.09	339	70.8	14.72	17
12.	Laguna	63.62	338	72.2	14.60	16
13.	Mexican June	71.19	338	77.8	15.16	8
14.	Rockdale	72.17	360	77.8	14.43	7
15.	Paymaster—Neal	79.51	392	77.8	14.60	1
16.	Paymaster—Harpeth	75.75	384	77.8	14.20	2
17.	Ellis	63.77	333	73.6	14.57	15
18.	Delta Prolific	73.27	373	77.8	14.14	3
19.	Yellow Dent—Ferguson	59.50	301	73.6	15.04	19
20.	Yellow Dent—Stewart	46.03	232	71.5	15.54	20

Remarks—A fair crop of crimson clover was turned under this spring on this field. This land was turned three times before planting, heavy rains delayed planting.

Neal's Paymaster led the list with 79.5 bushels per acre. This variety in the past has stood at the top in yield. We feel justified in recommending Neal's Paymaster, Harpeth's Paymaster, Delta Prolific and Cocke's Prolific.

CORN AND BEAN TEST—1923

Two sets of plats consisting of two series each were planted to corn and beans. One set was planted after oats and the other set after vetch. The dates of planting were as follows: June 15, 1923 and July 2, 1923, and the size of plats 1/11 acre and 1/7 acre each. The average results of the four series will be found in the following table.

TABLE No. 8.

Method of Planting—	Average Yield in Bu. per Acre of the Four Series
1. 6 Rows Corn	48.2
2. 6 Rows Corn and Otootan Beans	45.5
3. 6 Rows Corn and Velvet Beans	31.3
4. 6 Rows: 2 Rows Corn to 1 Row Otootan Soy Beans	42.5
5. 6 Rows: 2 Rows Corn to 1 Row Velvet Beans	40.2

Remarks—Velvet beans in every row of corn reduced the yield of corn 16.9 bushels per acre. This method of growing beans in corn is the least desirable. Where the Otootan soybeans were grown in every row, the yield was reduced but little. From this year's results this is the best way to grow corn. In previous years, results where seasons were dry, the yield of corn was reduced considerably when the corn and beans were grown in the same row. We wish to state here that Otootan soybean is the most desirable variety of soybean for this purpose on these soils.

In the plantings of two rows of corn to one of beans, the comparative results are a little below what they have been an average season. The same number of stalks of corn per acre was grown.

Conclusion—Plant beans in your corn to keep up soil fertility.

Silage—Sorghum alone is used for silage on this Station. The variety known as Japanese Seeded Ribbon cane is grown entirely by this Station. This sorghum produces at least one-third more tonnage per acre on thin or fertile land than corn and is about as valuable ton for ton as corn silage, the corn silage being slightly more valuable. This sorghum has other advantages. Dry seasons the sorghum will stand the drouth better and at harvest time the sorghum will not damage if harvesting is delayed. Corn blooms but once and if the season is unfavorable at that time the silage will be poor. Sorghum should not be harvested for silage until fully ripe; immature sorghum will give sour silage.

All of our sorghum is grown after vetch is harvested from the land. This keeps up soil fertility. On good land, twenty tons of sorghum can be grown per acre, the average being ten or twelve tons. The seed of the sorghum take the place of the grain on the corn. Fertilize as for corn. Where increased tonnage is desired, use larger quantities of fertilizer.

SWEET POTATO SPACING AND VARIETY TESTS—1923

Soil—Brown Loam table land.

Size of Plats—Space Test, 1/38.294 of an acre; and Variety Test, 1/19.147 of an acre.

Fertilizer Used—300 lbs. Acid Phosphate, 150 lbs. Nitrate Soda and 100 lbs. Kainit.

Date of Planting—June 25, 1923.

Date of Harvesting—October 23, 1923.

TABLE No. 9.

Sweet Potato Spacing Test

Space In Drills	Plat Yield, Pounds	Yield in Bu. Per Acre
7	280	206.2
14	232	170.9
21	210	154.5
28	159	117.1

Sweet Potato Variety Test

Variety Used—	Plat Yield, Pounds	Yield in Bu. Per Acre
Dooley Yam	481	177.1
Porto Rico	362	133.3
Triumph	530	195.2
Nancy Hall	388	142.9

Remarks—The plantings were made too late for heavy yields. Excessive rains prevented soil preparation. There are 35.3 bushels increase in favor of the 7-inch space over the 14-inch space. If we take into consideration that it will take double the number of plants and double the cost of planting, the results will be in favor of the 14-inch space.

The yields are very low in the variety test, not more than half of the yield of a normal year. The Triumph has given the largest yield; this is not out of line as it is a leading variety in yields. The flesh of this variety is white and is used almost exclusively for late summer and early fall mar-

keting. The Triumph and Porto Rico are freer from diseases than other varieties.

The Nancy Hall and the Porto Rico are the principal varieties grown in this section for market.

Seed Selection and Treatment—The seed potatoes were carefully selected, using only clean potatoes, free from disease. These potatoes were soaked ten minutes in a solution of bichloride of mercury, one ounce to eight gallons of water, to destroy outside infection. It should be remembered that bichloride of mercury is very poisonous when taken internally, but not injurious to the hands or clothes. It is advisable to give all seed potatoes this treatment at planting time, regardless of how clean the potatoes may be.

Beds—Convenience for watering has much to do with the location, also the beds should be on land where no potatoes have been grown for the past five or more years. If a sloping hillside is used, begin making the beds at the bottom of the slope and each year move up the hill. If it becomes necessary to use the same beds each year, the soil should be removed and all parts of the bed disinfected with a solution of copper sulphate, 1 pound to 20 gallons of water. A wooden vessel should be used for this solution. We make our beds five feet wide and a six foot walkway between each bed. Elevation for drainage is made by removing six inches of soil from part of the walkway and putting it on the beds. Where early plantings of potatoes are desired, or when plants are grown for sale, hot beds are used to force the plants. Either the hot bed heated by fire or with green stable manure can be used.

The potatoes are placed so as not to touch and are covered with woods dirt or clean bank sand free from infection. This covering is usually about two and one-half inches deep.

If care is used sound potatoes taken from a black rot infested house and treated as above will give good results. It is in the seed bed that most of the trouble begins. The State Plant Board has taught us a lesson along these lines. Some of the potato growers that have unlawfully brought potato plants into the State, evading the Plant Board inspection, are having it come home to them by losing their entire crop by black rot. They not only lose the crop of potatoes but also infect their potato houses and fields, making the future growing of potatoes more hazardous on their farms. Diseased potatoes fed to livestock will infect the manure and in turn the soil where the manure is used. Vetch has been seeded to all of the land we planted to potatoes. The crop of vetch is removed for hay and the land prepared and fertilized as given above. After the crop of potatoes is harvested, the vetch comes up and gives a hay crop the next spring. We advise such a practice.

Soil for Planting—There is a common belief among some farmers that thin soil is the place to grow potatoes. It is true that some potatoes can be grown on thin soil, but it is not an exception to any rule. We have never found a crop that does better on a poor soil than on a fertile one and we never expect to find one. Select a good clay or sandy loam where no pota-

toes have been grown within five years unless the potatoes previously grown were free from diseases. Make rows three or three and one-half feet apart. Plants put out early in June give good yields. An application of 300 pounds acid phosphate, 150 pounds of nitrate of soda and 100 pounds of kainit per acre applied just prior to first planting gives good results. To freshen up the land just before planting is a good practice.

Harvesting Potatoes—A hay rake will assist greatly in removing the vines. We find it satisfactory to bar off the rows so as not to cut the potatoes with a single horse turning plow, which removes most of the vines left by the rake, then in the absence of a potato digger, throw out the potatoes with a middle breaker. The potatoes are distributed along the row in every third middle. This is done to prevent bruising. Assort the potatoes in this row and pack in crates or boxes ready for use and remove to the storage house and if possible allow them to remain in the crates. Field drying will assist materially in eliminating the excessive water and should be practiced where possible. It is through bruised or cut potatoes that diseases such as ring rot, storage rot, and other diseases are introduced. Cut potatoes should be stored separately and eaten or otherwise disposed of before decay begins. Bins not over four by four feet may be used in storing the potatoes.

The storage house should be thoroughly sprayed on the inside a week or ten days before the potatoes are dug. A solution of copper sulphate, one pound to twenty gallons of water, will destroy infection.

Curing the Potato—To get rid of the excess water in the potato is the next process. If the atmosphere is dry, open all ventilators and allow air to circulate freely during the day and close up at night. Keep fire going in the furnace or stove during the day. It usually requires two weeks to dry out small houses. The thermometer should register 75 or 80 degrees during the days to get the best results in curing the potatoes. Properly cured potatoes will stand four or five degrees below freezing which is an item to be considered in marketing during the winter and the proper temperature for keeping the house is between 45 and 55 degrees during the winter. Small variations will not injure the potatoes.

Vetch—Hairy vetch is the best variety we have so far found for this section. A variety test is being studied with much interest. It is believed that vetch is one of the most valuable winter cover crops for this section, probably not any more valuable than bur clover after the land is properly seeded, but the ease in which the land is seeded to vetch and its value as hay gives it first place. The hope for Southern agriculture is increased production; this can not be had without increased soil fertility. The cheapest way to increase soil fertility is by growing legumes. Then we come to the question, what legumes should we grow? When land is once seeded to vetch, it at once becomes a volunteer winter cover crop and works nicely with the growing of such crops as sorghum, corn, sweet potatoes, soybeans, cotton and other crops. The only place we have not found advisable to grow vetch on a farm is on land planted to strawberries. Vetch will put a berry patch out of commission unless the plants are destroyed, which we have

found expensive. It appears that some farmers have trouble in getting a start with vetch. The trouble really lies in their having not been sold to the importance of soil building. We call it a fool-proof legume that will come up in the fall after all cultivation has ended and grow during the entire winter, protecting the land from washing and if let alone will produce by May 15 from one to two tons of good hay per acre that can be harvested for livestock. Any crop except cotton can be grown after vetch has ripened seed on the land sufficient to furnish seed for other crops of vetch later. Crimson clover is fine but has to be seeded to the land each fall. We have not found it hard to seed land to vetch. We have over one hundred acres in vetch. It is growing on the sides of roads, on ditches, in orchards and vineyards, and, in fact, any place we will allow to become seeded. Fifteen pounds of seed will plant an acre of land. Select good soil to start with and use some manure on the land. If the land selected for vetch is in cotton, sow the seed in the middles of the cotton rows about the first of September and cover by cultivating the cotton. Inoculate the seed by mixing about one-half pound of soil from a vetch field with each pound of seed. Allow this planting to mature seed, which it usually does by the latter part of May. Turn the entire crop under and plant to other crops. In the fall of the year when the weather gets cool and there is sufficient moisture the vetch seed that are near the surface of the ground will germinate. It may be necessary to allow this crop of seed to mature, hay can be saved and fed to livestock. Seed will shatter out of this hay in feeding and become mixed with the manure. Scatter this manure at any time desired on land to be seeded to vetch. The seed in the manure will germinate in the fall, no inoculation of these seed is necessary and you have an enlarged field of vetch. Such a method will soon put vetch over your farm. We have a two year rotation on the farm that has been in practice for over ten years:—Cotton, where vetch comes up in the fall, the vetch should be allowed to mature some seed, after which harvest the hay and turn the land and plant to corn. The next year put the land back to cotton. Land in this rotation has made two bales of cotton per acre and ninety-two bushels of corn. The soil is better now than when these crops were grown. This land will grow such crops every year that we get a good stand and get the crop of cotton started early. It is necessary to supply at least 200 pounds of acid phosphate a year to each acre of this land, also about 100 pounds of kainit to keep up the mineral matter. We grow three crops in two years on this land. This land was seeded but once and that was over ten years ago. Vetch does not do well on wet soils or a very wet year.

Control the surface water on your farm and plant vetch.

Lespedeza—The farmers of the South have not fully realized what they have in this plant. There is no better hay grown and it is probably better adapted to these soils than any other soils of the State. It is one of the easiest crops to grow, no lime or inoculation and in many instances not even necessary to plant the seed. With the idle lands on nearly every farm there is no reason why this section should not have hay in abundance to sell. We have found this plant better adapted for bringing up very poor soils than any plant within our knowledge.

Lespedeza seed planted on oats at the rate of one bushel per acre will give a good cutting of hay the fall following. The time to sow lespedeza seed is the latter part of March. Harrow the land and sow the seed on the freshly harrowed soil without covering. Many farmers have found it most satisfactory to seed about half their land to lespedeza to be used for pasture, livestock, hay and seed saving for about three years and then putting this land into cultivation and seeding down the other half of the farm for the same purposes. Such a method has kept up lands to where they produced an average of one bale of cotton per acre with the use of only two hundred pounds of acid phosphate as a fertilizer. Mississippi would grow more cotton by such a method over a ten year period than she does today.

Bur Clover—The variety known as Southern bur clover is the best to plant. The seeding of land to this crop is rather a slow process and somewhat difficult. It requires about four bushels of seed to plant an acre. The seed are light, only ten pounds to the bushel, and are frequently damaged before harvesting. Probably the best time to sow the seed is as soon as harvested. Sow in the middles of cotton and cover by cultivating the cotton. In the fall after cultivation has ended when cool moist weather begins the seed will germinate. Allow this planting to mature seed before planting the land to other crops; this will be the latter part of May. One good crop of seed will put enough seed in the land to insure a crop of clover each year for four or five years. Land once well seeded to bur clover can be planted to cotton for three or four years in succession without allowing the seed to mature. To get the best results, such land should not be turned each year to plant cotton until a short time before the cotton planting season. Anthracnose some years gives trouble with bur clover. As no hay is harvested from this crop the soil is in a few years supplied with vegetable matter and nitrogen. We have a field seeded to bur clover we expect to use in a two year rotation. A small seed plat on a farm used for growing seed is the most satisfactory way to secure seed. It is not uncommon to harvest two hundred bushels of seed per acre. These seed usually sell for around $1.50 per bushel on the market.

ALFALFA

This Station has a circular on Alfalfa Culture that can be had from the Experiment Station, A. & M. College, Mississippi. Alfalfa will grow on almost any character of fertile land in this section if well drained, by the addition of four or five tons of limestone per acre. It seems to do better on clay hill lands. We have about twenty varieties under test, the seasons for the past two years have been very unfavorable, being so wet. The Native Grown or common alfalfa appears to give as good results as any variety in the test. One acre or more near the home for hogs and poultry to furnish early and late grazing will be found very profitable.

FORAGE CROPS

Soy Beans (*Otootan Soybean*)—We have had under observation for the past three years the Otootan soybean. This variety is far ahead of any other variety we have grown on the Station. While the variety is late ma-

turing, it is a most excellent forage plant. On fair land it will produce from two and one-half to three tons of hay per acre. Medium early plantings will mature seed in this latitude. The plant is a heavy fruiter and does not shatter out in the field like some of the other varieties. The beans are small and germinate easily, requiring only about one gallon to seed an acre properly. The beans should be planted in three foot rows and given about two cultivations to get the best results. The stems of this variety are small and abundant making a growth about four feet tall on average land. When planted in the row with corn they finally cover the entire middles. We believe that this is an ideal variety for planting with corn, as well as for forage.

Lareda Soybean—This is the first year we have grown this variety of soy bean. It is at least a month earlier than the Otootan and in general appearance resembles same in the early stages of growth. The seed are small and germinate well. The variety is an abundant fruiter. It requires about one gallon of seed to plant an acre, using three foot rows. This variety has attracted very much attention in the Mississippi Delta section and bids fair to supplant to a great extent the cow-pea, which in the past has been used so bountifully.

Biloxi Soybean—This is a late maturing variety and very tall growing. On good soil this bean will grow six feet tall. The stems of this variety are much coarser than the Otootan or the Lareda, but make a fine quality of forage. The beans do not shatter out easily and we have had no trouble securing a stand. The beans are larger than the two varieties named above, requiring about two gallons to plant an acre. We look on these three varieties as being the best for forage of any varieties tested at this Station.

Mammoth Yellow Soybean—This has been a standard variety for hay and for hogs for many years. The beans are large, requiring three or four pecks of seed to plant an acre. When cut in the dough stage, no better feed can be had, for it is both forage and grain. We have had trouble securing a stand with this variety. This bean at present is probably more universally grown than any of the bean family The variety shatters out badly in harvesting if not cut at the proper time. This variety is grown for oil and hog feed to a great extent. The meal secured in the process of extracting oil is but little less valuable for feed than cottonseed meal.

DAIRYING

The dairy at this Station was installed August 1, 1909, purely as a demonstration feature on the Station.

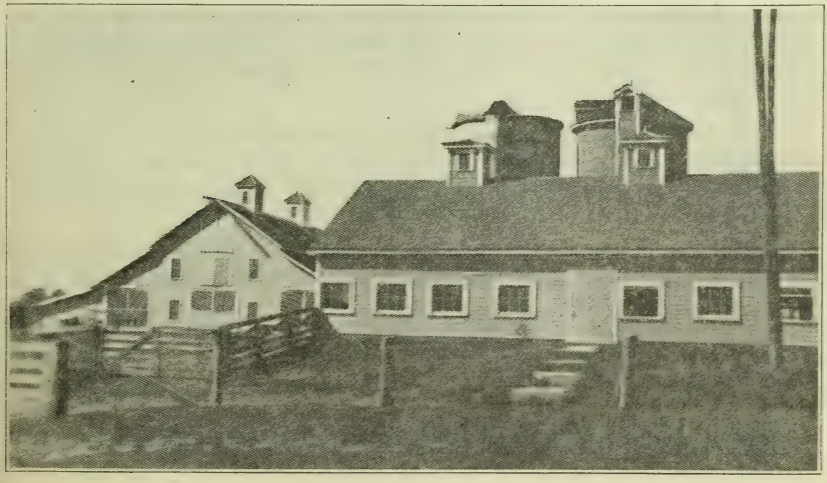
An attempt has been made to run the dairy so as not to interfere with regular Station work, leaving the experimental feature to the College herd at the A. & M. College, Mississippi; also to furnish a market on the farm for crops grown and to utilize the thin lands for grazing.

Grade cows, the kind that could be had in this county, cost an average of $33.25 each. For a time records have been kept; for a four-year period the herd averaged $65.00 net per cow. Several registered Jersey cows have

been added to the herd and in the future feeding experiments will be conducted. The value of manure measured in pounds of cotton or other crops has been a feature of our work. The dairy possibilities in this section are good. There is a creamery or milk market within forty miles and in many instances much nearer any farm in this section. There are thousands of acres of idle land that could be made to grow feed and pasture with but little expense. These lands have been put out of commission by tenant farmers growing cotton to buy hay to grow more cotton. There are good cows that can be had in almost any section without much effort. In many instances there are cows on the farms of men who could easily convert a shed (or build one) into a dairy barn and turn the cows in and go to milking. Cream separators are plentiful and can be had almost on your own terms. Many banks will lend money on cows as security to purchase other cows. Start with the best cows at hand and cull out the poorest ones by keeping records and purchase good ones in their places.

The boll weevils this year have shown us what they can do for cotton. While we believe we can still grow some cotton, the presence of the weevil makes the growing more hazardous. There is idle labor on the farm half the time that has to be fed all the time. The dairy farmer is about the only man in the country who has made ends meet for the past four years. If the idle lands of this section are ever redeemed, the dairy cow and poultry will play an important part. The richest sections of the United States today are those sections that make dairying their chief industry.

We have mild winters, cheap lands, cheap labor, long grazing seasons and can use inexpensive barns and our market facilities are just as good as any section on earth. The dairy need not interfere with the growing of cotton or other crops in the least. It will furnish a home market on the



Dairy Barn

farm for most of the crops grown. If you have good cows they will pay a good price for the feed. The cows will almost give you double value for the legumes they eat by utilizing the feed value and returning the manurial value to the farm.

We have a milking machine that has been in service over three years that has given perfect satisfaction. One person could with the use of the milking machine handle thirty cows a day, put in feed, clean up the barn and wash all milk vessels. We have had no trouble securing the desired labor. In many sections if you want to borrow money, put a few milk cans in your vehicle and drive up to your bank. Don't put off the job until it is too late. If you attempt to do dairying and buy all of your feed, you will be up against the same proposition as the cotton farmer who grows all cotton and buys feed; it will be hard to make ends meet.

LIME

We have nothing new to add to our lime results. Unfortunately our lime tests are located on level hill land and the excessive wet weather this year overcame everything; the soil was water-logged. We had over one hundred fertilizer experiments, also tests with manure in the same field, the results of which we are unable to print for the same reason.

Lime can be used in either of the following forms: crushed limestone (from one-quarter inch to dust), caustic or air slaked lime, or rotten limestone found in abundance in the Eastern and Southern parts of the State. It requires about one-half the caustic or air slaked lime per acre as it does either of the other kinds named. Two tons of crushed limestone per acre broadcasted has doubled the yield of cow-peas and soy beans. Lespedeza is the only legume within our knowledge that is not very much benefited by the use of lime. The rotten limestone could easily be handled without crushing. By breaking the larger pieces and distributing on the land, the weather will in a short time cause these lumps to break up and in time it will become scattered over the land. It would require more than two tons per acre in this way.

All of the clovers, vetches and alfalfa are benefited by the use of lime. In fact alfalfa can not be grown in this section without an application of four or five tons of lime per acre. One application of lime usually lasts for five or six years.

We believe these soils can be handled profitably only by terracing the lands, the use of two or three hundred pounds of acid phosphate per acre yearly, the use of two tons of limestone as a minimum to assist in growing legumes, from one to two hundred pounds of nitrate of soda to supply additional nitrogen according to the crop grown, the dairy cow to utilize the legumes grown and grazing lands and in no other way can they be maintained so cheaply and profitably.

In closing this report, we wish to state that Mr. H. F. Wallace and Mr. O. M. Ryan have done their best in making this a most profitable year, even under the most adverse weather conditions.

Bulletin 221 January, 1924

REPORT

Delta Branch Experiment Station

1922 and 1923

By
W. E. AYRES

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi
J. R. RICKS, Director

STATION STAFF.

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J. R. Ricks, M. Sc. ..... Director and Chief in Agronomy
M. H. Moore ..... Secretary and Financial Agent
E. B. Ferris, M. Sc. ..... Asst. Director, South Miss. Branch Station
C. T. Ames, B. Sc. ..... Asst. Director, Holly Springs Branch Station
C. B. Anders, B. Sc. ..... Asst. Director, Raymond Branch Station
W. E Ayres, M. Sc. ..... Asst. Director and Plant Breeder, Delta Branch Station
S. W. Greene ..... In Charge of Coastal Plains Branch Station*
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R. W. Harned, B. S. A. ..... Chief in Entomology
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J. F. O'Kelly, M. Sc. ..... Plant Breeder
J. C. C. Price, B. Sc. ..... Horticulturist
Earle Brintnall, B. Sc. ..... Dairyman
C. J. Goodell, B. Sc. ..... Associate in Farm Management
K. U. Jones, B. Sc., V. M. D. ..... Veterinarian
R. N. Lobdell, M. Sc. ..... Zoologist
W. S. Anderson, B. Sc. ..... Horticulturist, South Miss. Branch Station
H. F. Wallace, B. Sc. ..... Asst. at Holly Springs Branch Station
H. A. York, B. Sc. ..... Asst. at Delta Branch Station
H. H. Harned, M. S. ..... Associate in Bateriology
Rowland Cowart, B. Sc. ..... Associate Agronomist
Miss Kittie Sue Johnson, A. B. ..... Secretary-Stenographer
Miss Fannie Page ..... Stenographer
Miss Mary Alice Lanier ..... Addressograph Operator
D. W. McIlwain ..... Superintendent of Farm
D. Maxwell ..... Foreman and Herdsman
B. V. Evans ..... Farm Foreman, South Miss. Branch Station
J. C. Ryan, ... Farm Foreman, Holly Springs Branch Station
J. C. Peyton ..... Farm Foreman, Raymond Branch Station
K. C. Livingston ..... Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. ..... Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. ..... Collaborator
E. C. Ewing, M. Sc. ..... Collaborator

*In co-operation, Bureau of Animal Industry, U. S. Department of Agriculture.

BIENNIAL REPORT OF WORK AT THE DELTA BRANCH EXPERIMENT STATION.

1922-1923.

W. E. Ayres.

The Delta Section of Mississippi is comparatively small, but land values and taxes are high. This small area pays a very high percentage of the State taxes in proportion to its size. The soil is very fertile, naturally, and with present day drainage, sanitation, and good roads, no other section of the State, and no other area of similar extent in the United States presents such an array of agricultural opportunities. The almost limitless possibilities of this section are rapidly being recognized by its citizens, and by citizens of other sections. The Delta is rapidly waking up to the value of her soil as a wealth producer, and this wealth is being utilized more and more as time passes. Science is being applied to farming and the Delta is annually increasing the value of her farm products.

The Delta is small in area but exceedingly large in agricultural possibilities. The average annual value of the Delta cotton crop alone is above $60,000,000.00. By proper methods this value could soon be doubled and an abundance of other crops produced. The section will easily support twice as great a population and a much more intelligent class of labor.

Research is the source of much reliable agricultural information. This information has played a large part in guiding Delta planters in utilizing their soil and climatic resources. One of the greatest needs in the further development of the vast resources of the section, is the vigorous and active prosecution of experimental work, and the proper dissemination and utilization of sound and reliable data obtained through research.

The hearty co-operation and active participation of every citizen and agency in the use of Experiment Station results and in the financial support of the work are not only desirable but essential if the agricultural resources of the section are to be developed at a rapid rate. All citizens of the section are encouraged to use all Station results which will help make farming a more desirable and remunerative vocation.

Public Meetings—Delta planters have shown more interest in the Station during the biennium than ever before. More than 5000 visitors came to the Station during the summer of 1922, and the prospects are good for twice that many in 1923. Several of the Delta counties have annual days at the Station. The Cotton Co-operative Association has a mass meeting on the Station grounds annually. The meetings are all well attended. At the Association mass meeting in 1922 the attendance was 1,200 or more. On Coahoma County day 300 or 400 were present. There were more than 100 present on several other days. Several planters have indicated that they would bring 15 or 20 of their best tenants to the Station during the summer. Some tried the plan last year and found

it very satisfactory. In all probability more than 100 negroes will visit here this summer. From June 25 to September 30 from 10 to 75 persons visit the Station daily. During this period the time of one man is practically consumed by visiting farmers, and much of the time two are required to handle the crowds.

Visitors are free with favorable and unfavorable criticism—favorable toward the work, both quality and quantity done with funds available, and unfavorable toward the lack of funds with which to investigate so many problems. Hundreds have made special request that a budget large enough to more nearly meet the needs be asked for 1924-25. Several of our best men have indicatd that the Station should spend at least 35 or 40 thousand dollars a year. The sentiment is such as to make trouble if a much larger appropriation than the Station has ever had is not asked. Committees are at work in several counties now to make this sentiment unanimous. It is doubtful if such enthusiasm for Experimental Work exists anywhere else in the country.

Improvements—No new buildings have been erected during the biennium, but the barn has been painted, about two miles of new fencing erected, an outside wall put on the first story of the seed house, and considerable repairs made on the tool sheds, the shop, and the garages.

On the east side of the Station there is a ditch which carries practically all of the surface water on the Station, as well as that from 500 to 1000 acres belonging to neighbors. This ditch had been neglected until it was fillled up and grown up to such an extent that the surface water stood on 60 to 100 acres of the Station from three to six hours after heavy rains. In the summer of 1922 the Station joined the neighbors in cleaning and enlarging this ditch enough to partially relieve the trouble, but much more work will be required to solve the problem.

During the past winter the Station lawn has been graded, drained, and planted with trees and shrubs. With proper care the front can, in a few years, be made beautiful. Nothing could add more to the attractiveness of the Station than can be added by proper care of the grounds. To combine utility and beauty, pecan trees have been usd in the planting wherever consistent.

No fund was provided for improvements, and only these things have been done which were essential to good management and economy. Other w rk has been materially handicapped because of the necessity of doing the few things which have been done.

New Work—The following work was begun in the spring of 1923:

(1) Check row cultural work with cotton looking to the control of nut grass or coco.

(2) Cultural work with cotton to include different depths of cultivation, different dates of laying by, etc.

(3) Cultural work with corn to include different depths of cultivation, different dates of laying by, etc.

(4) Rates of seeding Fulghum and Red Rust Proof Oats.

(5) Miscellaneous legume and cover crop Nursery.

(6) Fall and Spring planting of various legumes in oats for summer hay crops.

(7 Residual effect of nitrogenous fertilizer on oats following fertilized corn.

(8) Tests of cotton fertilizers to include lime nitrate, acid phosphate, and mixed fertilizer. The above will be compared with nitrate of soda or tested in combination with nitrate.

Planting Seed—Probably 50% of Station maintenance is devoted to the development of better strains of field crops adapted to the locality. This part of the work has been very successful. Cotton bred at the Station is today worth more to the State annually than all Mississippi Experiment Stations have cost since they were established. Corn developed by the Station is more productive than other corns in the Delta section. Delta Station Rust Proof Oats have produced 70% more for the past three years than seed of the same variety bought commercially.

Experiments are never sacrificed or neglected for the sake of producing seed for sale, but all land unfit for experiments is used to increase outstanding productive strains of the various crops. All experiments in which seed is a constant factor are planted with seed which should be increased. All seed so increased, except enough corn and oats to feed Station livestock, is sold to Delta planters for planting purposes at reasonable prices.

More planting seed have been distributed during the present biennial period than ever before. Six hundred bushels of cotton seed, 625 bushels of corn (and 355 of Mosby corn by Mr. S. A. Brown, who co-operates with the Station in breeding Mosby), 360 bushels of oats, and 20 bushels of soy beans being sold in 1923 alone. This will permit the planting of 600 acres of cotton, 2,910 acres of corn, 180 acres of oats, and 120 acres of Laredo soy beans, or a total of 3,180 acres of farm crops with seed direct from the Station in 1923. If these seed are properly cared for and offered for sale in 1924, a very material part of the Delta acreage of the staple crops can be planted in 1925 with seed only two years from the Delta Station. The possible acreage in 1924 of Delta Station cotton should be augmented by the fact that all cottton seed sold were covered by a contract which safeguards their purity.

Delta Planters feel that it is almost criminal to feed oats and corn, which are very highly bred and very desirable for planting purposes, to Station livestock. This is a very unwise and expensive thing to do, but, until abundant funds are available or remedial legislation is passed, this will be necessary. If the Delta Station support bill were so written as to permit the use of the funds obtained from the sale of feed grains for seed purposes to pay labor to prepare such grains for seed and to replace

the feed lost through the sale of such seed there would be no excuse for feeding any grain suitable for seed purposes. Such a change in the wording of future bills would help to make the work of the Station more valuable to the State and would be true economy.

CORN.

With the exception of the new work with corn outlined above, corn experiments were continued along the same lines as outlined in the Director's 35th annual report.

Variety tests were failures in 1922 due to bad stands and damage by livestock belonging to neighbors, before maturity. The 1923 variety tests are very promising at this date.

Spacing tests have been conducted since 1920. In 1922 it was evident in dry weather that the 15 and 20 inch plots suffered much more than the thinner plots. Results and observations each year indicate that having too few plants is much better than having too many. The quality of the corn from the thin plots has always been much better than that from the thick ones. The corn from the very thick-spaced plots was very small and contained a great many worthless nubbins each year. The above experiments were not entirely satisfactory and are being repeated.

The information at hand, including experiments elsewhere, and close observation, indicates that corn is generally left too thick for best results About 5,500 plants per acre is probably safest. This number is obtained by leaving one plant every 24 inches in 4 foot rows, or one every 27 inches in 3½ foot rows.

The practice of planting peas or soy or velvet beans in the corn is known to be a good one, and one that should be more universal than it is. An experiment, conducted in 1921, repeated in 1922, and again in 1923, indicates that planting a legume in the corn reduces the corn yield, but that the combined value of the two crops is much greater than the corn alone. The enrichment of the soil is also an important consideration.

For buckshot and other heavy lands soy beans are best to plant in the corn. On loam and sandy land peas and velvet beans are probably as good. The addition of a legume to the corn field will make corn much more profitable.

Corn fertilizer work was begun in 1921. The soil is typical Deer Creek loam, which had been brought to a high state of cultivation by the use of legumes before the test was begun. Corn in 1922 followed cotton. The cotton in 1921 had identical fertilizer treatment, plot for plot, as the corn. These same plots are to be fertilied in the same way each year for at least five years.

Sources of Nitrogen—In planning this test in the spring of 1921 all materials which bade fair to offer commercial nitrogen for fertilizer purposes were considered. Since that time Calcium Nitrate, or Lime

Nitrogen, is being offered Delta planters in commercial quantities. This material will be compared with other standard commercial nitrogenous fertilizers in 1923.

Results of 1922 show an increase of 15.9% for cotton seed meal, 25.4% for ammonium sulphate, 30.2% for nitrate of soda, and an increase of 24.4% for a mixture of nitrate and cotton seed meal. Average results of 1921-2, which are more reliable, show that ammonium sulphate increased the yield 18.1%, nitrate of soda 16.8%, cotton seed meal and nitrate 18.1%, and cotton seed meal 12.5%.

All materials were applied at such a rate as to add 15 pounds of nitrogen per acre. In considering these results the prevailing market price of the various materials must be considered.

Rates of Applying Nitrate of Soda—In 1922, 50 pounds of nitrate per acre increased the yield 5.2%; 100 pounds, 17.4%; 150 pounds, 30%; 200 pounds, 47.4%; 250 pounds, 68%; and 300 pounds, 72.4%.

The average results for two years show the following increases: 50 pounds of nitrate per acre increased the yield 3.6%; 100 pounds, 11.5%; 150 pounds, 22.4%; 200 pounds, 28.6%; 250 pounds, 36%; and 300 pounds increased the yield 37.1%.

In considering the results fertility of soil must be considered. The area on which these tests were made will yield approximately 40 bushels without fertilizer. On ordinary land the increase from fertilizer would, in all probability, have been much greater.

Time of Applying Nitrate of Soda—Results at the Delta Station and elsewhere indicate that nitrate is often applied too late for best results. Planting time seems a little early. It is probably best to apply the nitrate at the first cultivation or not later than the second. Early applications will probably show up to better advantage on thinner soil. On thin soil the writer would not hesitate to apply nitrate at planting time.

Corn breeding has been in progress since 1921. Results have been very satisfactory. Rows planted from selected ears often yield 50% more than the best field selected seed of the same variety. Sufficient seed has been distributed in 1923 to give the Delta a good start of high producing corn, but much more work is needed.

A very interesting strain of Cocke Prolific is being observed in the breeding work this year. This particular strain averaged 15 inches high on June 15, and the surrounding strains averaged 27 inches high in both series. Photographs have been made and the strain will be watched with a great deal of interest in the hope that a productive prolific type with dwarf plants has been found. It is also realized, however, that it is likely to prove worthless.

COTTON.

Cotton experiments made in 1922 were published in Bulletin No. 215. A discussion here is unnecessary.

The work of 1923 is being conducted along the same lines with the

additions noted above. The work is all in excellent condition at present. Better stands have been retained than in previous years except on one of the variety tests.

The test of check-row cotton looks practical for bad coco lands. Hoeing can be practically eliminated and stands can be retained. Several planters have expressed the opinion that this method will aid materially in solving the coco and hoeing problems.

Fertilizers show very plainly in advanced plant growth at this time. For the first time since the experiments were begun, cotton seed meal caused the cotton to die when very young, and all cotton seed meal plots had to be planted over.

Two new strains of Delfos are being increased. One, Delfos No. 911, is a selection from Delfos 6102, and has longer lint, larger bolls, shows more storm resistance, and has been a better yielder for three yars than Delfos 6102. The other, Delfos 910, is a selection from Delfos 631. It has yielded considerably more, consistently, for three years, than its parent. Two or three tons of seed of each strain will be available for distribution in 1924 if nothing happens to the crop.

Oats—Oats receive little consideration in the Delta. Since a good crop of oats, and a hay crop of soy beans, clover, melilotus, or sorghum following, can be grown on the badly infested buckshot lands, this crop is undoubtedly one of the best feed crops for the section. The use of this sort of combination will release much labor for other lands from lands which have always been unprofitable in cultivated crops.

Variety tests have been made for three years. Average results of 1921 and 1922 were as follows: Hastings 100 bu., 61 bu, per acre; Ferguson 71, 59.7 bu.; Appler, 44 bu.; Fulghum, 40.6 bu.; and Dwarf Culberson, 25.9 bu. per acre. Yields of the 1922 test follow: Delta Station Red Rust Proof 56.1 bu. per acre; Commercial Red Rust Proof, 33.0 bu.; Hastings 100 bu. (Red Rust Proof), 52.1 bu.; Appler (Red Rust Proof), 51.1 bu.; Fulghum 708, 49.8 bu.; and Dwarf Culberson. 28.1. It will be noted that the best variety produced 100% more than the poorest, and that Commercial Red Rust Proof was outyielded by 70% by a selected strain. Results of 1923 are not available, since no threshing has been done, but Red Rust Proof strains will lead again by a very wide margin. It seems safe to recommend Ferguson 71, Hastings 100 bushel, or Appler, all of which are of the Red Rust Proof group, for general Delta planting.

All oats planted in 1922 were treated for smut by the dry formalin process with perfect success. A small area sown with untreated seed showed a loss of 12% in yield due to smut infection. Seed were not treated in 1923 and all fields were practically smut-free. This shows that seed treatment is not necessary every year if proper precautions are taken against infection.

Oat Breeding work has been in progress since 1920. Several promising new strains were isolated in 1922, but 1923 comparisons have been

made worthless by a storm which blew down all plots. More than 500 selections have been made in 1923 and a large nursery will be planted this fall.

Forage Crops—Tests were begun in 1922 looking toward solving the problem of the best crop to plant after oats, and the best variety of that crop. Comparative yields of the various crops planted broadcast, June 12, follow: Mammoth soy beans, 3,300 pounds of dry hay per acre; Whippoorwill peas, failure—killed by dry weather on buckshot soil; Mung beans, 2,730 pounds; Bush velvet beans, no stand; and Red Top Sorghum, 12,780 pounds of dry hay per acre. Sorghum produced much more hay than any other crop, but following these crops oats practically failed on the sorghum plots. Soil fertility must not be forgotten.

Yields of varieties of soy beans planted broadcast after oats, June 12, for hay, were as follows: Wilson. 4,100 lbs. of dry hay per acre; Virginia, 5,320 lbs.; Mammoth, 7,610 lbs.; Laredo, 5,360 lbs.; Barchett, 5,250 lbs.; Biloxi, 7,360 lbs.; and Otootan, 7,280 lbs. The large tonnage obtained from Mammoth and Biloxi is not as good as it looks on paper. At least 40% of it is woody stems, which are not edible. Virginia is also rather bad in this respect. The other varieties are viny and have small stems. They make hay of excellent quality. Barchett and Otootan are so late that they will fail to be ready to cut for hay by frost in early falls when planted after oats.

When planted in corn which was waist high, Otootan and Laredo soy beans made a good yield of forage and grain. Mammoth soy beans and Whippoorwill peas were failures under the same conditions.

Two acres of Laredo soy beans were planted on coco infested buckshot soil, for seed in 1922. The yield was 25 bushels of grain per acre and the threshed straw was fairly good for hay. Oats were planted after the soy beans and there is a perfect stand of volunteer soy beans on the land now, which bids fair to produce a good hay crop without further care than getting the oats off the land.

Yields of varieties of cowpeas planted broadcast for hay follow: Whippoorwill, 3.560 lbs.; New Era, 3,460 lbs.; Brabham, 3,220 lbs.; Groit, 2,960 lbs.; Victor, 3,440 lbs.; Clay, 3,060 lbs.; and Unknown, 3,940 lbs. of dry hay per acre. Until dry weather came the peas promised more hay than the soy beans, but the peas shed practically all of their leaves and quit growing—ripened prematurely during the hot, dry weather, and had to be cut early. The soy beans continued growth and matured a good crop of grain. The pea hay crop was not worth more than half as much as that of the soy bean, ton for ton. Acre for acre, the soy bean was worth practically four times as much as the pea hay.

Sorghum varieties ranked in yield in the order named: Crookneck, Seeded Ribbon, Hastings (badly mixed but primarily Orange), Orange, Amber, and Red Top. Ripening dates were as follows: Red Top, Oct. 5;

Amber, Oct. 7; Orange, Oct. 15; Crookneck and Seeded Ribbon, Oct. 25. All varieties were planted June 19.

The stand of the various varieties of velvet beans was too poor for records to be of value, but doubtless they injured the corn less, pound for pound of forage and grain produced, than did either peas or soy beans.

In the fall of 1922 work was begun in an effort to determine the best crop to plant in oats for a summer hay crop without having to plow or disk the land after oats are harvested. Duplicate plots of Melilotus, Alsike Clover, Red Clover and Lespedeza were planted in the oats in both fall and spring. So far Alsike Clover and Lespedeza look best. All fall planted Melilotus winter killed, and the spring sown plots do not look promising.

Livestock—No livestock experiments have been in progress since the early spring of 1920. Enough sheep and hogs are kept to consume the waste. These are sold to the butcher.

Publications—The following bulletins have been published: No. 209, Alfalfa in the Delta, February 1922; No. 210, Vegetables and Truck for Home Use, March, 1922; No. 207, Nitrogenous Fertilizer Experiments, April, 1922; and No. 215, Cotton Experiments, 1922, January, 1923.

In April, 1922, posters were distributed which showed, graphically, results of cotton spacing experiments. Actual data were published on the same poster. At the same time in 1923, 2,500 posters showing both cotton spacing and fertilizer data, were published and distributed. The posters are more popular than any other publications issued by the Station. Several planters have said that the excellent stands of cotton both this year and in 1922 are largely due to the posters on cabins, barns, post offices, stores and bank windows throughout the section. Several men have expressed themselves as being willing to pay for them, personally, rather than do without them. This method of publication reaches the tenants. They are the only ones who must ultimately be reached if satisfied labor is to exist. The latter is necessary to successful farming.

Acknowledgments—The hearty co-operation of all employes; the constructivee criticism, favorable comments, and hearty moral support of Delta Planters; the courtesy of the President, Director, and Secretary; and the splendid co-operation of all Delta County Agents and the administrative officers of the Extension Division, contributed materially to the wonderful success of the Station during the biennial period.

Respectfuly submitted,

W. E. AYRES,

Assistant Director in Charge.

Stoneville, Mississippi, June 30, 1923.

DELTA STATION NEEDS AND RECOMMENDATIONS.

FOR THE 1924-25 BIENNIAL PERIOD.

Hard times have hit the Delta Station. Most of its troubles are due to insufficient funds. Since 1920 the experimental area has been increased over 300%. The number of plots and experiments have been increased proportionately. The maintenance budget for 1922-23 is the same as for 1920-21. For 1922-23 nothing was allowed for improvements, whereas an improvement fund of $20,000.00 was used in 1920-21. The Station has made only a very small percentage of the necessary improvements and a fund for this purpose is an absolute necessity if the Station is to progress and meet the needs of the Section.

Since 1915 land values in the Delta have increased from 100 to 300%. The cost of producing a crop on the average Delta plantation has probably increased in nearly the same ratio. The funds of the Station are only 70% greater than in 1918-19. For this reason some very serious problems confront the Station.

Never in the history of the Station have the demands for results of research been so unprecedented. These demands come from Farmers, County Agents, Extension workers, Chambers of Commerce and business men individually. It is the chief business of the Station to furnish such data, but the supply is far short of the demand. However great this discrepancy, the work of the Station must slow down and fall far short of meeting present-day and future requirements unless appropriations are materially increased.

The Experiment Station requires labor which is more intelligent and more industrious than the average. For the sake of efficiency the Station should be in position to command plenty of the best common labor in the country, and a few skilled, intelligent workers for the most particular work. Instead of being able to do this the conditions of finances and quarters have made it necessary to take a limited quantity of the labor left after mills and the best plantations have met their requirements.

There is another serious feature of the situation. Able, well trained and experienced men and women are absolutely essntial for scientific experimental work. Present funds will not permit the employment of a sufficient number of efficient workers. All classes in the Delta look to the Station for agricultural leadership. This can only come from an abundance of ability and experience. At least one other man assistant is needed, and a competent, well paid Secretary-Stenographr would be an invaluable addition to the Station staff.

The Delta has many pressing agricultural problems calling for experimentation and research, which the Station has either been unable to touch, or has only been able to deal with superficially because of lack of funds. Among these are farm machinery, rotation of crops, oats,

summer and winter legumes, corn culture, nut grass control or eradication, and local experiments.

Of all sections of the South the Delta area is best adapted to the use of improved farm implements. The Delta Station receives many inquiries concerning the practicability of various tractors, cultivators, and other farm machines. To date there have been no funds with which to test any machines except those absolutely essential to the conduct of ordinary Station operations. It would certainly be more economical for the Station to have funds with which to investigate various implements than for each individual farmer to take a chance and probably, if not surely, buy much poor and impractical equipment.

The Delta knows practically nothing about crop rotation, oats, corn growing, or legumes. Each year the soils are being depleted of plant food and humus. Feed bills are increasing while the labor supply and farm income per acre decreases. Some way to reduce the feed bill, increase per acre production and soil fertility, and to use fewer men and more farm machinery must be found. Delta Planters of the section are asking the Station to solve the problem. The Station has demonstrated during the period covered by this report that there are varieties of soy beans, viz. Laredo and Otootan, which will make paying crops with little labor on lands which are entirely unprofitable in other crops. In 1923 yields of 30 to 50 bushels of oats per acre were produced in coco infested, low, tight buckshot soil following soy bean hay, and the land had no preparation whatever after the hay crop was removed. The grain drill was run over the soy bean stubble at a cost of less than $3.00 per acre for seed and labor.

A winter legume adapted to Delta farm practices would add much to the production of the section and reduce the annual bill for fertilizers by more than has been spent in maintaining the Delta Station since it was founded.

Practically all of the corn fed in the Delta area is imported. The freight bill paid annually by the planters would support corn investigation by the Station for several years to come. Certainly enough money to investigate cultural methods, develop strains of corn adapted to the alluvial area, and to demonstrate that feed can be produced more economically than it can be bought and transported, should be forthcoming. By proper use of such feed crops as corn, oats, soy beans, clover and alfalfa, the labor supply necessary to operate the plantations can be materially reduced, soil fertility increased, and the section made more nearly independent and self sustaining.

Coco or nut grass is one of the worst noxious grasses the country has ever seen. It is spreading very radiply in the Delta. If some practical means of eradication or control is not found, in ten years there will be thousands of acres of Delta lands abandoned because of coco infestation. A practical method of eradication would be worth millions of dollars to

the Delta alone, not to mention other sections of the country. Ample funds should certainly be provided for extensive and intensive investigation of this problem.

There is now a great demand for local experiments with fertilizers and varieties of cotton. Some of this work is being conducted this year and a small amount was done in 1922. Probably this should be continued, but more closely supervised, for the sake of a closer contact between the Station and the average Delta citizen, and for data on various soil types and conditions.

Aside from the crying need for funds for maintenance of present work and beginning other much needed projects, many improvements of the Station property are essential to efficient work. The most pressing need of the Station is a gin and gin equipment. The necessity of ginning at a public gin is a distinct reflection on the Station and the State. All Delta Station Breeding and experimental cotton must be shipped to the A. & M. College to be ginned and the seed shipped back. Cotton seed which have cost the State 8 or 10 thousand dollars is shipped both ways annually. Fortunately none of this has ever been lost, but it is very risky. It is possible to wreck a train and lose it all. The probability of losing a few bags is very great. The loss of the original bag of Delfos would have been almost criminal, since it is now available in sufficient quantity to be worth, in increased yields, to the Delta alone, several million dollars a year. Small gins to handle this material on the Station are essential.

Ginning the main crop of the Station at a public ginnery is expensive, to say nothing of the danger of gin-mixing pure strains of the high producing cottons from increase breeding plots. When this ginning is done the entire Station crew has to go to the gin, and it is necessary to wait until custom ginning is practically over. In addition to this, regular ginning charges are paid, and many chances of losing the identity of important cottons are encountered. Complete gin equipment is badly needed and would add greatly to the safety and efficiency of the cotton investigations.

The great need for an auditorium in which to hold meetings is common knowledge in the Delta. In the summer of 1922 on Staple Cotton Association day more than a thousand people got wet two or three times while trying to hear talks in the open. The ladies of Leland had prepared lunch, and had it not been for the fact that Association officials acted quickly, and paid the entire bill, at least $600.00 worth of food would have been ruined by rain. (The tables were set and lunches served on paper plates. A hasty rain came up which would have spoiled practically all food had it been necessary to collect for each plate individualy.)

Much more storage space is needed for farm machinery, and for sheaf oats between harvest and threshing time. Many farm implement

manufacturers would donate implements to the Station if ample storage space were provided. About two car loads of donated machinery are in use at the Station now, and one of the largest manufacturers of implements indicates a desire to send one or two cars of its latest output in the near future. The Station needs much more equipment but has almost as much as it can house until other buildings are erected. To meet all needs it seems that a two-story structture will not only be best adapted but decidedly the most economical type of structure. Rest rooms for both men and women should be provided on the first floor, and the remainder of the space beneath the auditorium used for storing mahcinery not in constant use. This can easily be constructed with a part of the sales funds if the assembly will consent.

The Station farm is comparatively well drained, but the construction of a few surface drains and deepening and widening the open ditch on the east side will greatly increase production and help to prevent the rapid spread of noxious grasses and weeds. On the Station farm is a partially wooded tract of low land. On it there is practically no timber of value even for firewood. It is primarily a boll weevil harbor and an eyesore. As soon as funds for labor are available it will be cleared, stumped, drained and utilized. It will then be an asset to the Station and the State rather than a liability, as at present.

The Station cabins are all very poor. It will soon be impossible to keep labor if three cabins are not built and the best old ones repaired. The negro quarters on the Station are by far the poorest in the community. The average good negro laborer today demands a good house. Something must be done on this point, and that quickly, if the experiments are to be handled with anything except the poorest negro labor. This would not only be inefficient but very dangerous, as is always true when there is any doubt about the reliability of results upon which conclusions are based.

Because of the recognized value of, and the great need for fundamental research, surely the State will not be miserly with the Delta's only State institution. The Delta pays more than one-fourth of the taxes of the State. Of the total yield of cotton in the State, from 40 to 55% of it is produced in the Delta. Delta cotton values comprise from 50 to 60% of the value of the Mississippi crop. Cottons bred at the Station are now worth 8 to 12 million dollars annually to the Delta alone, in increased yields over the best commercial varieties. Delta Station cottons are valuable to other sections of th State. Many of the valleys all over the State are being planted to Delfos and Express. Planters are willing to demand support for the Station, but surely the needs will be liberally and wisely provided for when they are properly presented.

In view of the needs the following budget should be doubled, but the condition of the State's finances has been considered, also:

ANNUAL BUDGET RECOMMENDED FOR 1924-25 BIENNIUM.

Salaries—	
Assistant Director and Plant Breeder	$3,150.00
Assistant	2,400.00
Assistant	1,900.00
Foreman	1,400.00
Secretary-Stenographer	1,200.00
Labor	8,400.00
Miscellaneous—	
Mules	$ 500.00
Machinery and Tools	1,500.00
Material	1,500.00
Stamps and Stationery	250.00
Publications	600.00
Power, Heat and Light	625.00
Travel	250.00
Freight and Express	175.00
Seed and Plants	350.00
Fertilizers	225.00
Library	150.00
Furniture and Fixtures	125.00
Sundries	325.00
Improvements, 1924 Only—	
Gin and Gin Equipment	$7,500.00
Building and Repairing Cabins	2,000.00
Auditorium and Tool House (from sales if allowed)	10,000.00

Respectfully submitted,

W. E. AYRES,

Assistant Director in Charge.

Stoneville, Mississippi, June 30, 1923.

DEMOCRAT-TIMES
GREENVILLE,
MISS.

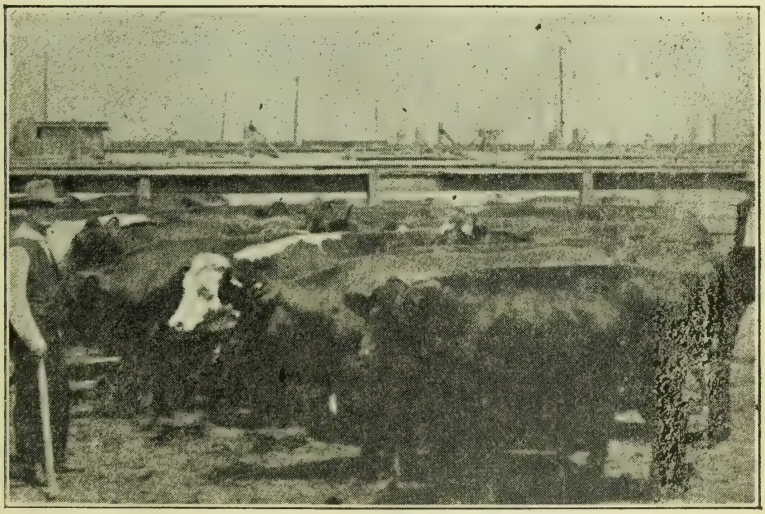
Bulletin 222. May, 1924.

Steer Feeding Experiments

Corn Silage Versus Corn and Soybean Silage. Velvet Bean-and-Pod Meal, Cottonseed Meal, and Varying Proportions of Corn and Velvet Bean-and-Pod Meal. Corn, Sorghum, and Sunflower Silages

by

C. J. Goodell.



Mississippi Experiment Station steers sold May 8. 1918, bringing highest price paid up to that time for cattle marketed from any state below the Ohio river.---Summary of Feeding, page 8.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi.
J. R. Ricks, Director.

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J. R. Ricks, M. Sc. ..... Director and Chief in Agronomy
M. H. Moore ..... Secretary and Financial Agent
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Miss Fannie Page ..... Stenographer
Miss Mary Alice Lanier ..... Addressograph Operator
D. W. McIlwain ..... Superintendent of Farm
D. Maxwell ..... Foreman and Herdsman
B. V. Evans ..... Farm Foreman, South Miss. Branch Station
J. C. Ryan ..... Farm Foreman, Holly Springs Branch Station
J. C. Peyton ..... Farm Foreman, Raymond Branch Station
K. C. Livingston ..... Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. ..... Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. ..... Collaborator
E. C. Ewing, M. Sc. ..... Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

Steer Feeding Experiments.

CORN SILAGE VERSUS CORN AND SOYBEAN SILAGE

During the winter of 1916-17 the steer feeding work at this station included two lots of eight head each, both of which received cottonseed meal in similar amounts per one hundred pounds of live weight, lot I receiving corn silage and lot II corn and soybean silage.** The amount of silage fed was regulated by what the steers would eat up clean after each feed.

CATTLE

Good to choice native two-year old steers of Angus, Hereford, and Shorthorn breeding were used. At the beginning of the trial they were in rather thin condition, averaging in weight 852 pounds.

FEEDS

Choice cottonseed meal was purchased locally at forty dollars per ton and was charged against the cattle at that price. The corn silage used would probably have contained from four and one-half to five bushels of grain per ton. In a previous report (Bulletin 214) corn silage was charged at four dollars per ton, which price was used by Mr. Gayle, Animal Husbandman in charge. Where the feeding of cattle is one of several competing farm enterprises, it would seem that silage should properly be charged at the value of the grain contained plus the difference between the cost of ensiling and cribbing. Using this method of calculation the cost of corn silage for Mississippi in 1916 was, in most instances, probably not less than $5.50 per ton, at which price it is charged in the financial statement herewith. No record being available as to the relative yields, it is difficult to fix a proper charge for corn and soybean silage and the same price is here used as for corn silage. That the yield was heavier than for the corn silage, however, is evidenced by a charge in the preliminary report of $3.00 per ton. According to analyses of the silages it will be seen that the

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*ACKNOWLEDGMENT—The first two trials reported herein were conducted by Mr. H. K. Gayle, former Station Animal Husbandman, and these reports have been compiled from records in the station files. The purpose has been to present all essential data as concisely as possible.

**Lot I is discussed in Mississippi Experiment Station Bulletin 214, "Experiments with Feeding Steers, Using Cottonseed Meal and Varying Proportions of Corn and Cottonseed Meal."

corn silage this year contained about thirty-seven per cent more dry matter to the ton than did the corn and soybean silage.*

METHOD OF FEEDING

The cattle in each lot were started on two pounds of cottonseed meal daily per head and this was increased at the rate of one pound a week until five pounds daily per thousand pounds live weight were reached. At the beginning of the second sixty day sub-period the average daily feed per steer was raised to six pounds of cottonseed meal per thousand pounds live weight of cattle. The daily ration was divided into two equal feeds and the steers were fed at 6:30 A. M. and 4:30 P. M. The silage was placed in the troughs and the meal scattered over it. Any feed remaining after two hours had elapsed from the time of feeding was removed and weighed.

MANAGEMENT

The two lots of cattle occupied similar quarters, having access to shelter and open lots. Except for cinders and shavings no bedding was used as the plan of the experiment limited the roughage fed to corn and corn and soybean silages, and it would have been impossible to have prevented the steers from eating part of the bedding had straw or old hay been used for that purpose. Water was supplied from deep wells and was kept before the steers at all times. Salt was provided at regular intervals.

WEIGHING

At the beginning and end of the trial the steers were weighed individually three days in succession, the average of the three weights being used as the initial and final weights. The cattle were also weighed at the end of the first sixty-two days.

MARKETING

As it was impossible to secure a car immediately upon conclusion of the trial, the cattle this year were held an additional twleve days during which time it was necessary to substitute waste hay for part of the silage in the ration. Lot I made an average daily gain per steer during this time of .8 pounds, and lot II of 1.99 pounds. The per cent of shrink given in the summary was based on the difference between the final home weight and the weight over the scales at East St. Louis. The market weight given was estimated by deducting from

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* ANALYSES OF SILAGES, 1916-17
(Made by Mississippi State Chemical Laboratory)

	Moisture	Ash	Fat	Protein	Nitrogen-Free Extract	Fibre
Corn and Soybean Silage	73.24	1.8	.55	1.81	14.20	8.40
Corn Silage	63.30	1.8	.61	2.24	21.48	10.57

According to these analyses, the corn silage contained about 37 per cent more dry matter to the ton than the corn and soybean silage. Unfortunately, more data are not available on this point.

the weights at the conclusion of the trial the respective percentages of shrink.

In as much as cattle frequently shrink in the feed lot following a change of feed from succulent to dry roughages, the shrink given herein may be deceptive in judging the merits of the two silages.

TABLE I

SUMMARY OF TRIAL WITH CORN SILAGE VERSUS CORN AND SOY BEAN SILAGE

Date of Trial—October 17, 1916 to February 14, 1917.
Length of Trial—120 days.
Breeding of Steers—Angus, Hereford and Shorthorn Grades.
Age of Steers—Two years old.
Quality of Steers—Good to choice.
Initial Valuation of Steers, per cwt.—$7.00.
Number of Steers per Lot—8.

LOT	I	II
RATION	Corn Silage	Corn and Soy Bean Silage
Initial weight, total (lbs.)	6935.	6700.
Average initial weight (lbs.)	866.9	837.5
Final weight, total (lbs.)	8847.	8760.8
Average final weight (lbs.)	1105.9	1095.1
Total gain (lbs.)	1912.	2060.8
Average gain per steer (lbs.)	239.	257.6
Average daily gain per steer (lbs.)	**1.99**	**2.15**
Estimated weight at market, total (lbs.)	8298.4	7884.8
Estimated average weight at market (lbs.)	1037.3	985.6
Estimated total shrink (lbs.)	548.6	876.
Estimated shrink per steer (lbs.)	68.6	109.5
Per cent of shrink	6.23	10.
Dressing per cent, based on market weight	56.6	56.2
Dressing per cent, based on home weight	53.09	50.58
Feed consumed, total—		
Cottonseed meal (lbs.)	5239.	5076.8
Silage (lbs.)	66970.	61120.
Feed consumed per steer—		
Cottonseed meal (lbs.)	654.9	634.6
Silage (lbs.)	8371.3	7640.
Average daily feed consumed per steer—		
Cottonseed meal (lbs.)	5.46	5.29
Silage (lbs.)	69.76	63.7
Feed required per cwt. of gain—		
Cottonseed meal (lbs.)	**274.**	**246.35**
Silage (lbs.)	**3502.6**	**2965.8**
Cost of 100 pounds of gain	$ 15.11	$ 13.08
Selling price of steers per cwt.	$ 10.05	$ 9.87
Gross receipts per steer	$104.25	$ 97.28
Shipping and selling expense per steer	$ 3.52	$ 3.52
Net receipts per steer	$100.73	$ 93.76
Initial valuation per steer in feed lot	$ 60.68	$ 58.63
Feed cost per steer	$ 36.12	$ 33.70
Initial valuation and feed cost per steer	$ 96.80	$ 92.33
Profit*	$ 3.93	$ 1.43

*The term "Profit" as used refers to the excess net receipts over the cost of steer and feed. In calculating "Profit" no account was taken of labor, interest, risk, etc. This should be borne in mind, otherwise the term will be misleading.

From a study of these data it will be seen that based on feed l weights lot II, receiving corn and soybean silage, made slightly larg and more economical gains than lot I, receiving corn silage. Based the difference between the initial weight and the estimated mark weight this order is reversed. Because of the delayed marketing, ho ever, the market weight and shrink shown are of little value for co parative purposes.

It will be noted that the steers in lot II consumed less silage th those in lot I. Based on a single set of analyses of silages for th year, the dry matter consumed in lot I was 1539 pounds and in lot 1020 pounds.

While the dressing per cent was about the same in each lot difference in finish was indicated by the selling price, lot I bring $10.05 per cwt. and lot II, $9.87. This may have been partially due the difference in initial weight.

VELVET BEAN-AND-POD MEAL, COTTONSEED MEA AND VARYING PROPORTIONS OF CORN AND VELV BEAN-AND-POD MEAL FOR FATTENING STEERS

For the purpose of studying the relative economy of velvet b and-pod meal, velvet bean-and-pod meal and corn, and cottonseed m when fed with silage to beef steers, the Mississippi Experiment Sta in the winter of 1917-18 fed five lots of beef cattle for one hun and forty days. Corn silage was fed ad libitum to all lots throug the trial. Cottonseed meal, velvet bean-and-pod meal, and broken corn were fed in accordance with the following plan:

CONCENTRATES FED DAILY PER THOUSAND POUNDS C CATTLE

LOT	I	II	III	IV
First 56 Days				
Cottonseed Meal (lbs.)	5.	—	—	—
Velvet Bean-and-Pod Meal (lbs.)	—	10.	8.	6.
Broken Ear Corn (lbs.)	—	—	6.25	12.5
Second 56 Days				
Cottonseed Meal (lbs.)	6.	—	—	—
Velvet Bean-and-Pod Meal (lbs.)	—	12.	10.	8.
Broken Ear Corn (lbs.)	—	—	6.25	12.5
Last 28 Days				
Cottonseed Meal (lbs.)	7.	—	—	—
Velvet Bean-and-Pod Meal (lbs.)	—	14.	12.	10.
Broken Ear Corn (lbs.)	—	—	6.25	12.5
Average for Entire Period (140 Days)				
Cottonseed Meal (lbs.)	5.8	—	—	—
Velvet Bean-and-Pod Meal (lbs.)	—	11.6	9.6	7.6
Broken Ear Corn (lbs.)	—	—	6.25	12.5

It will be noted that there was a wide variation in the total concentrates in these rations, the amounts used in lots I and II being especially adapted to the greater utilization of roughage. The amount of velvet bean-and-pod meal in lot II was twice that of the cottonseed meal in lot I. In lots III, IV, and V, six and one fourth pounds of broken ear corn was substituted for each two pounds of velvet bean-and-pod meal replaced.

CATTLE

The cattle used in this trial were good to choice grade beef steers bought locally in the fall of 1916. They were grazed through the summer of 1917 and from frost until being put in the feed lots had the run of stalk, pea, and velvet bean fields. At the beginning of the trial they averaged in weight 1017.7 pounds and were appraised at $8.00 per cwt. The steers in lot I averaged 62.5 pounds heavier than those in the other lots.

HOGS

Hogs were used to follow all of the cattle except those in lot I receiving cottonseed meal. These were purchased locally, averaging 73.3 pounds and costing $16.00 per cwt., were fairly well bred and would have graded as good feeders. In the four lots the hogs were used in the ratio of one per steer throughout the trial. They were allowed access for about an hour each day to a self-feeder containing for the first fifty-six days corn and cottonseed meal in separate compartments, and for the remaining eighty-four days corn and tankage.

FEED PRICES

In the financial statements herein velvet bean-and-pod meal was charged at $32.50 per ton, cottonseed meal at $50.00 per ton, corn at $1.50 per bushel, corn silage at $7.50 per ton, and tankage at $100.00 per ton.

TABLE II

SUMMARY OF FEEDING TRIALS WITH VELVET BEAN-AND-POD MEAL VERSUS COTTONSEED MEAL VERSUS VARYING PROPORTIONS OF BROKEN EAR CORN AND VELVET BEAN-AND-POD MEAL FOR FATTENING STEERS

1917-18

Date of Trial.....December 11, 1917 to April 30, 1918
Length of Trial.....140 Days
Breeding of Steers.....Shorthorn, Red Poll, Angus, and Hereford Grades
Quality.....Good to Choice
Initial Valuation per cwt.....$8.00

LOT	I	II	III	IV	V
RATION	C.S.M., Silage	Velvet Bean-and-Pod Meal, Silage	Velvet Bean-and-Pod Meal, Light Corn Ration, Silage	Velvet Bean-and-Pod Meal, Medium Corn Ration, Silage	Velvet Bean-and-Pod Meal, Heavy Corn Ration, Silage
Number of Animals	8.	8.	8.	8.	8
Initial Weight, total (lbs.)	8540.33	8058.	8015.66	7969.66	8125.33
Average Initial Weight (lbs.)	1067.54	1007.25	1001.96	996.21	1015.66
Final Weight, total (lbs.)	10664.33	9835.66	9828.66	10376.66	10464.33
Average Final Weight (lbs.)	1333.04	1229.46	1228.58	1297.08	1308.04
Total Gain (lbs.)	2124.	1777.66	1813.	2407.	2339.
Average Gain per Steer (lbs.)	265.5	222.21	226.62	300.87	292.38
Average Daily Gain per Steer (lbs.)	**1.9**	**1.59**	**1.62**	**2.15**	**2.09**
Weight of Steers at Market, total (lbs.)	10270.	9350.	9470.	9950.	10050.
Average Weight at Market (lbs.)	1283.75	1168.75	1183.75	1243.75	1256.25
Total Shrink (lbs.)	394.33	485.66	358.66	426.66	414.33
Average Shrink per Steer (lbs.)	49.29	60.71	44.83	53.33	51.79
Per Cent of Shrink	3.7	4.94	3.65	4.11	3.96
Dressing Per Cent, Based on Market Weight	59.1	59.5	59.	58.6	61.4
Dressing Per Cent, Based on Home Weight	56.9	56.7	56.8	56.2	59.
Feed Consumed, total—					
Cottonseed Meal (lbs.)	6496.				
Velvet Bean-and-Pod Meal (lbs.)		12992.	10742.	8512.	6272.
Broken Ear Corn (lbs.)			7000.	14000.	21000.
Silage (lbs.)	87550.	80670.	59490.	42880.	33230.
Feed Consumed per Steer—					
Cottonseed Meal (lbs.)	812.				
Velvet Bean-and-Pod Meal (lbs.)		1624.	1342.75	1064.	784.
Broken Ear Corn (lbs.)			875.	1750.	2625.
Silage (lbs.)	10943.75	10083.75	7436.25	5360.	4153.75
Average Daily Feed per Steer—					
Cottonseed Meal (lbs.)	5.8				
Velvet Bean-and-Pod Meal (lbs.)		11.6	9.59	7.6	5.6
Broken Ear Corn (lbs.)			6.25	12.5	18.75
Silage (lbs.)	78.17	72.03	53.12	38.29	29.67
Feed Required per cwt. of Gain—					
Cottonseed Meal (lbs.)	**305.84**				
Velvet Bean-and-Pod Meal (lbs.)		**730.85**	**592.50**	**353.64**	**268.15**
Broken Ear Corn (lbs.)			**386.1**	**581.64**	**897.82**
Silage (lbs.)	**4121.94**	**4537.99**	**3281.3**	**1781.47**	**1420.69**
Cost of 100 Pounds of Gain	$ 23.10	$ 28.89	$ 30.21	$ 24.89	$ 28.92
Selling Price per cwt. (St. Louis)	$ 16.91	$ 16 68	$ 16.86	$ 16.76	$ 16.99
Gross Receipts per Steer	$217.08	$194.95	$199.58	$208.45	$213.44
Shipping and Selling Expense per Steer	$ 4.29	$ 3.91	$ 3.96	$ 4.16	$ 4.20
Net Receipts per Steer	$212.79	$191.04	$195.62	$204.29	$209.24
Initial Valuation per Steer in Feed Lot	$ 85.40	$ 80.58	$ 80.16	$ 79.70	$ 81.25
Feed Cost per Steer	$ 61.31	$ 64.20	$ 68.43	$ 74 89	$ 84 57
Initial Valuation and Feed Cost per Steer	$146.71	$144.78	$148.59	$154.59	$165.82
Profit per Steer*	$ 66.08	$ 46.26	$ 47.03	$ 49.70	$ 43.42

*The term "Profit" as used refers to the excess net receipts over the cost of steer and feed. In calculating "Profit," no account was taken of labor, interest, risk, etc. This should be borne in mind, otherwise the term is misleading.

Lot IV receiving velvet bean-and-pod meal and a medium amount of corn made the largest daily gains and, excepting lot I receiving cottonseed meal, made more economical gains than any of the other lots. Lot I made the cheapest gains and selling only eight cents per cwt. under lot V made the best financial showing of all the lots. Lot II, receiving an average concentrate ration of 11.6 pounds of bean-and-pod meal, consumed six pounds less silage per head daily than lot I, receiving an average concentrate ration of 5.8 pounds of cottonseed meal. Lot III consumed about 19 pounds less silage per head daily than lot II and in lots IV and V the amount of silage consumed decreased as corn was increased in the ration.

DRY MATTER AND DIGESTIBLE NUTRIENTS IN RATION, DIGESTIBLE NUTRIENTS PER CWT. OF GAIN, AND NUTRITIVE RATIO

LOT	I	II	III	IV	V
Dry Matter in Ration (lbs.)	25.92	29.42	26.89	25.45	25.64
Digestible Nutrients in Ration (lbs.)	18.37	21.19	20.47	20.48	21.58
Digestible Nutrients per cwt. of Gain (lbs)	968.75	1335.75	1264.49	952.93	1033.49
Nutritive Ratio 1:	5.11	7.94	8.12	8.46	9.02

Although the total concentrates increased as corn was added, there is no great variation noted in the different lots in the dry matter and digestible nutrients in the respective rations. Lot IV consumed the least amount of digestible nutrients per cwt. of gain, in this respect showing slightly greater efficiency than lot I. The greatest amount of nutrients per cwt. of gain was required in lot II. A study of the nutritive rations shows that in all except lot I the rations used were wider than is generally recommended.

As indicated by the selling price and dressing per cent, lots V and I ranked first and second respectively in degrees of finish.

The steers this year made satisfactory gains and sold at East St. Louis May 8, 1918, for the highest price paid up to that time for cattle marketed from any state below the Ohio river. The margin or difference between the cost and selling price per cwt. averaged for the forty head $7.84, reflecting advancing values and accounting for the large profits shown in all lots.

Results of trials at other stations indicate that it does not pay to grind or crush the velvet beans and pods for feeding steers. Work along this line has been done by the Coastal Plains Sation. McNeill, Mississippi, the Alabama Experiment Station, Auburn, Alabama, and by the Animal Husbandry Division, Washington, D. C.

TABLE III

HOGS FOLLOWING STEERS ON VELVET BEAN-AND-POD MEAL AND VELVET BEAN-AND-POD MEAL AND CORN—1917-18

Number of Hogs Used per Lot.....
Cost per cwt.....$16.0
Selling Price per cwt.....$17.5
Length of Time in Lots.....140 Day

LOT	II	III	IV	V
RATION	Velvet Bean-and-Pod Meal, Silage	Velvet Bean-and-Pod Meal, Light Corn Ration, Silage	Velvet Bean-and-Pod Meal, Medium Corn Ration, Silage	Velvet Bean-and-Pod Meal, Heavy Corn
Initial Weight, total (lbs.)	582.33	533.66	601.33	
Average Initial Weight (lbs.)	72.79	66.71	75.17	
Final Weight, total (lbs.)	1413.66	1493.66	1673.33	
Average Final Weight (lbs.)	176.71	186.71	209.17	
Total Gain, Pork Produced (lbs.)	831.33	960.	1072.	
Average Gain Per Hog (lbs.)	103.92	120.	134.	
Average Daily Gain per Hog (lbs.)	**.74**	**.86**	**.96**	
Market Weight (lbs.)	1418.	1498.	1677.5	
Feed Consumed, total—				
Shelled Corn (lbs.)	1100.	1174.	1084.	744
Cottonseed Meal (lbs.)	129.	101.	91.	74
Tankage (lbs.)	117.	112.	112.	103
Feed Consumed per Hog—				
Shelled Corn (lbs.)	137.5	146.75	135.5	93
Cottonseed Meal (lbs.)	16.13	12.63	11.38	9
Tankage (lbs.)	14.63	14.	14.	12
Feed Required per cwt. of Gain				
Shelled Corn (lbs.)	**132.32**	**122.29**	**101.12**	
Cottonseed Meal (lbs.)	**15.52**	**10.52**	**8.49**	
Tankage (lbs.)	**14.07**	**11.67**	**10.45**	
Total (lbs.)	**161.91**	**144.48**	**120.06**	
Cost per cwt. of Gain	$ 4.64	$ 4.12	$ 3.44	$
Gross Receipts	$248.67	$262.70	$294.18	$28
Shipping and Selling Expense*	$ 9.12	$ 9.63	$ 10.79	$
Net Receipts	$239.55	$253.07	$283.39	$27
Initial Valuation of Hogs	$ 93.17	$ 85.39	$ 96.21	$10
Cost of Feed	$ 38.54	$ 39.58	$ 36.92	$ 2
Initial Valuation of Hogs and Feed Cost	$131.71	$124.97	$133.13	$12
Profit from Hogs	$107.84	$128.10	$150.26	$14
Profit per Hog	$ 13.48	$ 16.01	$ 18.78	$ 1

*Based on home weights shipping and marketing expenses amounted to $.64 per

Estimating that about five hundred pounds of feed are requi to produce one hundred pounds of pork, the gains in each lot wh might be credited to the steers are as follows: Lot II, 564; lot III, 6 lot IV, 815; and lot V, 809.

Valuing the pork credited to the cattle at $16.89 (farm va conclusion of trial) the profits per steer in each of the lots were: II, $58.08; lot III, $61.39; lot IV, $66.93; and lot V, $60.48. This g lot IV a slight advantage in profit over lot I.

These results indicate the importance of using hogs in the feed lots with fattening cattle where the ration includes corn or velvet beans, or both. The feed required per cwt. of pork produced in the different lots increased with the total concentrates consumed by the steers. The total amount of pork made in lot V, however, where the steers received the heaviest feed was less than in lot IV. This is not explained by the difference in amounts of feed consumed by the hogs in the two lots.

CORN, SORGHUM, AND SUNFLOWER SILAGES

About four acres of sunflowers were planted by this station in 1921 for the purpose of comparing the feeding value of sunflower silage with that of corn and sorghum silages. The sunflowers were planted on bottom land and though the season was dry they made a yield of eleven tons per acre.* As the corn and sorghum silages were not grown under strictly comparable conditions no comparison of yields is attempted except to say that the tonnage of sunflowers was greater than either of the other crops. The sunflowers were harvested when the seed were just starting to glaze, and when about half of the heads were beginning to droop. It is probable that a little greater maturity should have been secured before ensiling. The corn and sorghum were harvested as soon as the grain had ripened and before the leaves had commenced to deaden to any considerable extent. A little greater difficulty was experienced in handling the sunflowers than with the corn and sorghum, owing to the drooping of the sunflower heads.

CATTLE

Twenty-four two year old steers were used this year, being divided into three lots of eight each, as nearly uniform as they could be made in breeding, quality, condition, and weight. Representation was about equally distributed among the three leading beef breeds, Angus, Hereford, and Shorthorn. At the beginning of the trial they averaged 978 pounds.

FEED PRICES

The cottonseed meal used was of choice grade and was charged against the cattle at $38.00 per ton. Corn silage was charged at $4.00 per ton, and sorghum and sunflower silages at $3.50 per ton. The Johnson grass hay would have graded number three to number two and was charged at $8.00 per ton.

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*The yield was determined by weighing the crops from a measured acre representative of the area planted.

ANALYSES OF SILAGES USED

(Made by Mississippi State Chemical Laboratory)

	Moisture	Ash	Fat	Protein	Nitrogen-Free Extract	Fibre
Corn Silage	71.67	1.87	.7	2.33	15.32	8.11
Sorghum Silage	71.18	1.64	.76	1.82	18.27	6.33
Sunflower Silage	71.58	3.42	1.61	3.44	12.61	7.34

From these analyses it will be seen that the sunflower silage was higher in ash, fat, and protein than the others and lower in nitrogen-free extract. Unfortunately, analyses were secured from but one set of samples as there was probably considerable variation in all the silages throughout the trial, especially in the moisture content.

PRELIMINARY HANDLING

During the fall of 1921 the cattle had been run on stalk fields where they had lost some of the gains made during the summer. About a week before the beginning of the trial they were brought up to the barn and fed hay and two pounds of cottonseed meal per head daily.

STARTING ON FEED

The cattle in all lots were started on three pounds of cottonseed meal per head daily and this was raised at the rate of about a pound a week until they were receiving six pounds per thousand pounds live weight. They were fed twice daily at 6:30 A. M. and 4:30 P. M. The silage was placed in the troughs and the meal mixed with it.* The amount of silage was regulated by what the steers would consume clean after each feed. Any feed remaining after two hours from the time of feeding was removed and weighed. At the start five pounds of coarse Johnson grass hay was fed. This was reduced in amount as the trial advanced.

WEIGHING

Each steer was identified by a number branded on the left rump. The steers were weighed individually three days in succession at the beginning and close of the trial, the average of the three weights being used as the initial and final weights. During the progress of the trial they were weighed at intervals of twenty-eight days.

*In some of the previous trials the cottonseed meal was scattered over the silage but not mixed with it. Mixing was thought to be advisable in order to prevent any of the steers that might be more greedy than the rest from consuming too large an amount of concentrates.

TABLE IV
AVERAGE DAILY RATIONS BY SUB-PERIODS

LOT NO.	I	II	III
RATION	C.S.M., Hay, Corn Silage	C.S.M., Hay, Sorghum Silage.	C.S.M., Hay Sunflower Silage.
First Sub-Period (28 days)—			
Cottonseed Meal (lbs.)	4.25	4.25	4.25
Johnson Grass Hay (lbs.)	4.46	4.46	4.46
Silage (lbs.)	46.34	47.95	47.23
Second Sub-Period (28 days)—			
Cottonseed Meal (lbs.)	6.21	6.21	6.21
Johnson Grass Hay (lbs.)	3.54	3.47	3.54
Silage (lbs.)	52.03	56.12	60.76
Third Sub-Period (28 days)—			
Cottonseed Meal (lbs.)	7.00	7.00	7.00
Johnson Grass Hay (lbs.)	3.00	3.00	3.00
Silage (lbs.)	58.84	61.43	67.19
Fourth Sub-Period (24 days)—			
Cottonseed Meal (lbs.)	7.96	7.96	7.96
Johnson Grass Hay (lbs.)	3.00	3.00	3.00
Silage (lbs.)	50.63	55.83	53.23
Average Daily Feed for Entire Period (108 days)—			
Cottonseed Meal (lbs.)	6.29	6.29	6.29
Johnson Grass Hay (lbs.)	3.52	3.50	3.52
Silage (lbs.)	52.01	55.31	57.25

From a study of the average daily rations it will be noted that after the steers became accustomed to silage they consumed only a small amount of dry roughage. The consumption of corn silage was smallest during each sub-period. During the second and third sub-periods the consumption of sunflower silage was greater than that of either of the others and for the entire trial the consumption of silage in lot III was largest of the three lots. From the first the sunflower silage was relished and was fully as palatable as either of the others.

TABLE V
AVERAGE DAILY GAIN BY SUB-PERIODS

LOT NO.	I	II	III
RATION	C.S.M., Hay, Corn Silage	C.S.M., Hay, Sorghum Silage	C.S.M., Hay, Sunflower Silage.
First Sub-Period (28 days)	3.39	4.61	3.35
Second Sub-Period (28 days)	1.56	.85	1.83
Third Sub-Period (28 days)	1.58	.80	.98
Fourth Sub-Period (24 days)	1.68	1.37	1.44
Average for Entire Period (108 days)	2.07	1.85	1.92

A study of the gains by sub-periods shows that all lots made large gains during the first twenty-eight days. As the scales were carefully tested for accuracy at all times this was probably the result of a heavy fill at the time of that weighing, although the cattle were handled in similar manner previous to the taking of all weights. The average gains for the period, while not large, were satisfactory in all lots.

TABLE VI

CORN, SORGHUM AND SUNFLOWER SILAGES.

1921-22

nber of Steers per lot 8
e of Trial ..... December 20, 1921 to April 7, 1922
gth of Feeding Period ..... 108 Days
ial Valuation, per cwt. $5.00

T NO.	I	II	III
TION	Corn Silage	Sorghum Silage	Sunflower Silage.
ial Weight, total (lbs.)	7841.7	7775.	7851.7
rage Initial Weight (lbs.)	980.2	971.9	981.5
al Weight, total (lbs.)	9628.3	9373.3	9506.7
rage Final Weight (lbs.)	1203.5	1171.7	1188.3
al Gain (lbs.)	1786.6	1598.3	1655.
rage Gain per Steer (lbs.)	223.3	199.8	206.9
rage Daily Gain per Steer (lbs.)	**2.07**	**1.85**	**1.92**
ight at Market (lbs.)	9110.	8840.	9100.
al Shrink (lbs.)	518.3	533.3	406.7
rage Shrink per Steer (lbs.)	64.8	66.7	50.8
Cent of Shrink	5.38	5.69	4.28
ssing Per Cent, Based on Market Weight	57.84	56.63	55.21
ssing Per Cent, Based on Home Weight	54.73	53.41	52.85
d Consumed, total—			
Cottonseed Meal (lbs.)	5440.	5440.	5440.
Johnson Grass Hay (lbs.)	3042.	3026.	3042.
Silage (lbs.)	44935.	47790.	49461.
d Consumed per Steer—			
Cottonseed Meal (lbs.)	680.	680.	680.
Johnson Grass Hay (lbs.)	380.3	378.3	380.3
Silage (lbs.)	5616.9	5973.8	6182.6
rage Daily Feed per Steer—			
Cottonseed Meal (lbs.)	6.29	6.29	6.29
Johnson Grass Hay (lbs.)	3.52	3.50	3.52
Silage (lbs.)	52.01	55.31	57.25
d Consumed per cwt. of gain—			
Cottonseed Meal (lbs.)	**304.5**	**340.4**	**328.7**
Johnson Grass Hay (lbs.)	**170.3**	**189.3**	**183.8**
Silage (lbs.)	**2515.1**	**2990.**	**2988.6**
st of 100 Pounds of Gain	$11.41	$12.36	$12.12
ling Price, per cwt.	$ 7.50	$ 7.25	$ 7.10
ss Receipts per Steer	$85.41	$80.11	$80.76
tial Valuation per Steer in Feed Lot	$49.01	$48.60	$49.08
d Cost per Steer	$25.48	$24.70	$25.07
tial Valuation and Feed Cost per Steer	$74.49	$73.30	$74.15
fit per Steer*	$10.92	$ 6.81	$ 6.61

*The term "Profit" as used, refers to the excess net receipts over the cost of steer d feed. In calculating "Profit" no account was taken of labor, interest, risk, etc. his should be borne in mind, otherwise the term will be misleading.

The dressing per cent and the selling price per cwt. indicate that the best finish was obtained in lot I, receiving corn silage. Lot II showed probably the least finish. These data conform to the judgment of all passing upon the relative value of the lots.

From this trial it would seem that sunflower silage is a very satisfactory feed for beef steers, comparing favorably with corn and sorghum silages. Though some greater difficulty is experienced in handling the crop than with corn and sorghum, the factor determining its use for silage purposes will probably be the yield per acre and cost of production as compared with other crops.

Report From

HOLLY SPRINGS BRANCH EXPERIMENT STATION

For 1924

By C. T. Ames

Crimson Clover after Corn as a Soil Building Project.

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. Ricks, Director

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K. C. Livingston — Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. — Supt. Farm Management Vocational Project
H. E. Brown, Ph. D. — Collaborator
E. C. Ewing, M. Sc. — Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

HOLLY SPRINGS BRANCH EXPERIMENT STATION
1924

The work of the Holly Springs Branch Experiment Station goes continually on in its march toward the development of a successful and progressive agriculture for this section of the state. Although handicapped at times by drouths, insect pests and other scourges of nature, the workers realize that these are only a part of the game and fight on to discover the correct method with which to surmount any obstacle that might appear. During the past year, some of the fertilizer plats on very thin land were destroyed by the extremely cold and wet spring followed by a drouth that lasted through the summer and fall. Extensive boll weevil projects conducted by Mr. T. F. McGehee of the State Plant Board accomplished little in experimental work because the weevils were practically controlled by weather conditions.

Cooperative fertilizer tests were made at Amory, Olive Branch, and Ingomar at a small cost. These tests are considered very valuable. With the exception of cultivation, which is done under farm management, they received Station supervision in applying the fertilizers and in picking the plats. A very extensive addition in fertilizer experiments has been made. A small tract of valley land was leased by the Station to be used in increasing seeds of desirable varieties of cotton and corn, and in increasing our scope in the fight against the weevil. Forty fertilizer plats which were also duplicated were added to this unimproved land, the results of which should be interesting to farmers of this section. Many visitors have expressed the belief that this is one of the most valuable projects conducted by this Station this year.

Soil improvement has had attention at all times. It has long been recognized that a fertile soil is the basis of successful agriculture and a poor soil is a curse to civilization. Nearly every acre of cultivated land on the Station grows a legume of some kind, either summer or winter and in some instances both seasons each year.

Special attention has been given cotton. Spacing and variety studies have been made on both hill and valley land. Variety studies have also been made with corn and sweet potatoes, also fertilizer tests. Alfalfa, lespedeza, vetch, soy beans and dairying, together with pasture grasses, have had their place in the year's work.

SOIL WASHING—Controlling surface water on the farms of the South where there are frequent rains and freezes and thaws during the winter is the most important business confronting Southern agriculture today. A fertile soil is the basis of successful agriculture and is so considered by every one. If all of the soils in this country were as fertile as they were when put into cultivation, the most of our troubles would vanish.

No soil will keep up its fertility under continued cropping without restorative crops unless it overflows each year and a deposit is left on the surface. No soil, unless extremely sandy or properly protected by terraces that have even a slight fall, can stand the washing that takes place during heavy rains and maintain its fertility any extended period unless protected by winter cover crops and the frequent growing of legumes, preferably both summer and winter legumes, with the addition of mineral fertilizers.

It is practicing poor business methods to attempt to build up land by growing these legumes and the use of farm manures without first checking soil washing. The necessity of this work is manifest by a look at the broken hill-sides and the decreasing fertility of our lands. In this section today steep hill-sides that were cleared less than ten years ago, and should never

have been cleared unless sodded to Bermuda grass, are now in many instances abandoned on account of soil washing, being too poor to cultivate. The most serious thing that could happen on most farms is happening every time there is a heavy rain, the soils are getting poorer and poorer from surface washing. Poor cultivation with grassy middles left in the fall check soil washing and is all that has prevented greater destruction. In many instances, ten years of continued cropping on land without growing restorative crops does not do the damage that occurs in one year where surface water is uncontrolled.

After nineteen years work on soil reclaiming projects on waste land in most instances, we can truthfully say that allowing surface water to go uncontrolled, thus washing away the soil's fertility, is an unpardonable crime. Almost every farm ill vanishes where there is a fertile soil and trouble increases as the farm grows poorer by allowing it to wash.

Every county agent and every land-lord and every tenant should make terracing the farm the main work from the time the crop is gathered in the fall until time to begin the next crop. Start on the best acre first and then the next best acre and continue until every foot of the farm is properly protected. Every acre of farm land in the South that is in cultivation can be terraced by the labor cultivating same between the gathering of one crop and time to prepare for the next.

The cost per acre is about one man's labor for one day, or better, two men and a team for one-half day That means when a man has cultivated twenty acres it will require ten days for two men and a team to terrace this amount unless gullies have been allowed to form. Gullies will get larger each year if let alone.

Increased production and growing a diversity of crops, including enough for farms needs, together with proper marketing are the principal needs of the State. Production cannot be increased indefinitely if the soils are allowed to wash away from neglect. The probability is that taxes will increase and if the soils get poorer, what will be the end? Control surface washing and grow legumes together with winter cover crops. This will require fences. If you cannot fence now, grow soy beans or beans of some kind in all corn and after oats. If you do this, you can soon fence your farm, as the land will begin after the first year to be more productive. Any man with average intelligence can be taught to terrace in one-half day under proper instructions. It's easy if you have the will. All of the State Experiment Stations have bulletins on drainage or terraces, the Extension forces have experts on this work that are anxious to assist any farmer. As proof of what controlling surface water and growing of legumes will do, this Station made three quarters of a bale for an average in cotton and over fifty bushels per acre in corn in 1923 with an average of a rain about every other day during the growing season and an average of one-half an inch for each rain. This year, 1924, we are making more than a bale of cotton on some land and as high as sixty-five bushels corn on part of our land with no rain of any consequence the latter part of the growing season. A normal year we have grown as high as two bales of cotton and ninety bushels of corn on our best land. This change was not brought about in one year, it has taken many years. Many farmers have much better land to begin with than this Station had. Terrace and grow legumes or go broke. You can terrace when you wish to borrow money from the Federal Farm Loan Bank, why not do so to prevent having to borrow. County Agents are much more active at present than in the past in laying off terraces.

COTTON

The requirements for growing cotton successfully in the future are:—a fertile soil, the judicious use of fertilizer and boll weevil poison, together with proper cultural methods adapted to the several cotton growing sections. We are of the opinion that there is enough information available on growing cotton under boll weevil conditions to warrant the statement that if this information should be put into practice, the South would grow more cotton than ever before in spite of the weevil. At present there is no need of alarm from over production. Those who have acquired this information have profited. We have never seen the public in more of a receptive mood than at present and we predict great strides in the near future. If the South will feed herself in this undertaking she will make true progress.

PREPARATION AND CULTIVATION:—In the hill section on account of soil washing during winter, we recommend that all the vegetable matter possible be left on the land as a protection and that these lands not be prepared until spring for cotton. Sod land should be turned in the fall or winter and left rough. Valley land may be prepared for cotton during the fall and winter if water is properly controlled on the land, otherwise but little is gained. On rolling land unprotected by terraces and where every row has more fall than it should have, soil washing will be increased by fall plowing. We will give only two ways to prepare and fertilize land for cotton. Where two furrows are turned together, or listed, it is a common practice to apply the fertilizer on this list by hand or with a fertilizer distributor. The middles are then thrown out and the land harrowed just prior to planting. The other method is to prepare the land in rows, open the rows and distribute the fertilizer covering with a harrow. If possible apply the fertilizer a week or ten days prior to cotton planting otherwise planting can be done just behind the fertilizer distributor.

SEED BED:—A well prepared seed bed that has been settled by rains is ideal. When the fertilizer can be applied a week or ten days ahead of planting, the frequent rains that usually prevail in the spring will give a firm seed bed. In case of dry weather use the roller after planting.

WIDTH OF ROW:—For fertile valley land, three and one-half foot rows are sufficient. On thin upland, three foot rows are very satisfactory.

TIME OF PLANTING:—Cotton planting time in this latitude is between April 25th and May 10th. It appears that the time changes going South from this place at the rate of about twenty miles per day, that is ,the planting time one hundred miles south of here on the Columbus and Greenville Railroad is about April 20th or five days earlier. When cotton is planted earlier than date given nine years out of ten a poor stand is secured and as a result second planting is made late in May. The past year earlier planting succeeded better than dates recommended. This is the case about one year out of ten. It is far better to plant medium early and secure a good stand than plant early and get a poor stand. Early planting is necessary and a good stand is essential. Late planting and poor stands are both very unsatisfactory, often causing a failure in the crop. The easiest way to increase a cotton crop from twenty-five to fifty per cent without one cent of additional cost is to get a stand of cotton.

A STAND OF COTTON:—On hill land a stand of cotton is from three to four stalks of cotton in bunches per foot, on valley land two to three stalks in bunches per foot. It appears that about the only excuse for thinning cotton at all is to be able to use the hoe freely. Blocking the cotton out, leaving the blocks twelve to fourteen inches apart, is not very far from good spacing. In one instance this year (1924) unthinned cotton on valley land

gave the highest yield. In other instances, less stalks gave good results The length of the growing season (long) easily explains why the wider space gave such good results this year as there was but little boll weevil damage. The best results with close spacing of cotton can only be obtained by the use of a proper balanced fertilizer. Cotton seed should be planted very shallow and in medium elevated rows. It is advisable to use about one and one-half bushels of seed per acre. A good practice is to run the planter twice down a row using about three pecks of seed each trip. The first trip will plant the seed a little deeper than the second trip; this method will increase the chances for a stand.

FERTILIZERS:—See recommendations under fertilizer experiments.

VARIETIES:—See recommendations under variety studies.

CULTIVATION:—Cultivation should begin as soon as the plants are established sufficiently not to be injured. Thin or block out as soon as possible and give frequent shallow cultivation.

EARLY POISONING:—Calcium arsenate applied in the bud of the cotton just as the squares begin to show, if any weevils can be found, or about the time the earliest squares are about half grown will kill the weevil. Either the sweet poison or the dust form will do the work. If labor is plentiful, use a mixture of one pound of calcium arsenate, one gallon of black strap molasses and one gallon of water applied with a mop or otherwise to the bud. If labor is scarce, use calcium arsenate dust from a hand or power machine. A second application ten days later should be made if any weevils can be found. From our results it appears that all of the weevils are out of hibernation and in the field by the time of the second application even on the earliest planted cotton. These two applications will probably control the weevils on thin upland assisted by dry weather. On valley land it may be necessary to continue poisoning. After there is a ten per cent infestation use calcium arsenate dust as recommended by Mr. Coad, or, what is known as the Government Method, which is, make three applications of dust poison about four days apart and after this hold the weevil to about a twenty per cent infestation until the cotton quits growing by additional applications of poison. Our results this year (1924) do not warrant any change in our recommendations last year. Only about four per cent of the weevils emerged from hibernating quarters this spring in comparison with last year and showed up in our emergence study plats. The cold winter destroyed many weevils. The small emergence followed by hot dry weather gave almost complete control. Our boll weevil circular is available at the office of the Experiment Station, A. & M. College, Mississippi.

VARIETY TESTS WITH COTTON—1924

Two tests were made, one on hill and one on valley land. Each test was in one row plats repeated four times. The seasons were unfavorable. there was extremely wet and cold weather at the planting and early growing part of the year and very hot and dry the latter part of the growing season. All plantings were made a second time and only a fair stand secured. Some replanting was made by hand. The date of planting on the hill was May 6th and on the valley May 19th. The stand secured of one variety was about as good as the stand of another.

The hill land test was on brown loam table land that would make about three quarters of a bale of cotton under normal conditions. The valley land test was on land capable of growing two bales of cotton any season that an early start and a good stand is secured. Tables No. 1 and No. 2 give the results of these variety tests.

TABLE NO. 1 VARIETY COTTON VALLEY LAND TEST 1924

VARIETY USED	Total Yield Seed Cotton Per Acre	Lint Per Cent	Lbs of Lint Per Acre	Length of Lint	Value of Lint Per Pound	Value of Lint	Dollars Per Acre Seed And Lint	Rank in Money Value
Trice, Miss. Sta.	1591.1	31.0	493.2	1-16	25.00	123.30	$145.26	7
Trice Burd.	1371.4	30.4	416.9	1-F	24.75	103.18	122.27	18
Cleveland Wann.	1032.2	36.2	373.7	15-16	24.25	90.62	103.79	24
Cleveland Coker	1247.0	35.6	433.9	1-	24.50	106.31	122.57	17
Cleveland Pied	1181.1	34.5	407.5	15-16	24.25	98.82	114.29	22
Cleveland 54	1295.8	33.6	435.4	1-	24.50	106.67	123.88	16
Half and Half	1452.0	38.5	559.0	7-8	23.75	132.76	150.62	4
Cook 1346	851.7	36.3	309.2	15-16	24.25	74.98	85.83	25
Willis	1434.0	32.9	472.1	1-	24.50	115.56	134.92	10
Miller	1232.4	32.8	404.2	1-1-16	25.00	101.05	117.61	21
Acala	1212.8	34 7	420.8	1-1-16	25.00	105.20	121.04	19
D & P L No. 4	1251.9	36.2	453.2	1-1-16F	25.25	114.43	130.40	12
Lone Star 65	1425.1	32.0	456.0	1 1-8	26.00	118.56	137.94	8
Lone Star 65 B3	1513.0	31.9	482.6	1 1-8	26.00	125.48	146.09	6
Salsbury	1103.0	31.5	374.4	1 1-8	26.00	97.34	111.91	23
Webber 49-6	1254.3	28.5	357.5	1-1-4F	31.00	110.83	128.77	13
Webber Delta TP.	1242.1	28.6	355.2	1-1-4F	31.00	110.11	127.85	14
Delfos 631	1469.1	30.2	443.7	1-1-4F	31.00	137.55	158.06	3
Delfos 6102-911	1644.8	31.1	511.5	1-3-16F	27.75	141.94	164.61	2
Delfos 6102	1674.0	30.8	515.6	1-3-16F	27.75	143.08	166.17	1
D & P L No. 5	1134.7	30.6	347.2	1-1-4	30.00	104.16	119.91	20
Express Lightning	1459.3	29.3	427.6	1-3-16	27.00	115.45	136.18	9
Express 782	1359.2	30.6	415.9	1-3-16	27.00	112.29	131.16	11
Half & Half M								
Mahons Imp.	1405.6	39.5	555.2	7-8	23.75	131.15	148.16	5
Trice X								
Triumph 0317	1295.8	31.8	412.1	1-1-8	26.00	107.15	124.82	15

TABLE NO. 2 VARIETY OF COTTON HILL LAND TEST

Trice, Miss. Station	1023.5	34.7	355.2	1-	24.50	$ 87.02	$100.39	19
Trice Burd.	1026.5	34.1	350.1	-15-16F	24.50	85.42	98.95	21
Cleveland Wann.	998.6	38.6	385.5	7-8	23.75	91.56	103.82	15
Cleveland, Cork	1101.3	38.7	426.2	15-16	24.25	103.35	116.85	2
Cleveland Pied	1151.5	36.8	387.0	7-8	23.75	91.91	105.20	12
Cleveland 54	1079.5	37.1	400.5	15-16	24.25	97.21	110.79	6
Half and Half	1026.5	40.4	414.7	13-16F	23.50	97.40	109.64	7
Cook, 1346	1008.0	39.3	396.1	7-8	24.00	95.06	107.30	10
Willis	1045.3	37.2	388.9	15-16	24.25	94.31	107.46	9
Miller	1107.5	36.9	408.7	1 1-16	25.00	102.18	116.16	3
Acala	1048.4	39.8	417.3	1F	24.75	103.21	115.83	5
D. & P. L. No. 4	1107.5	40.3	446.3	1F	24.75	110.46	123.68	1
Lone Star 65	917.7	36.2	332.2	1 1-16	25.00	83.05	94.76	23
Lone Star 65-B3	1032.9	36.1	372.9	1 1-16	25.00	93.23	106.43	11
Salsbury	1017.3	34.6	352.0	1 1-16	25.00	88.00	101.31	18
Webber 49-6	763.3	30.8	335.7	1 3-16	27.00	63.64	74.23	25
Webber Deltatpe.	849.3	31.4	266.7	1 3-16F	27.75	74.02.	85.83	24
Delfos 631	992.4	35.1	348.3	1 1-8F	26.50	92.30	105.18	13
Delfos 6102-911	1001.7	34.5	345.6	1 1-8	26.00	89.86	102.98	16
Delfos 6102	1054.6	34.6	364.9	1 1-8	26.00	94.87	108.66	8
D. & P. L. No. 5	992.4	35.0	347.3	1 1-8F	26.50	92.04	104.94	14
Ex. Lightning	1014.2	33.3	237.7	1 1-8	26.00	87.80	101.33	17
Express -782	986.2	34.8	343.2	1 1-16F	25.25	86.66	99.52	20
Half & Half								
Mahons Imp.	1029.7	45.2	465.4	3-4	22.50	104.72	116.01	4
Trice X Triumph								
-0317	945.7	35.5	335.7	1F	24.75	83.09	95.29	22

VARIETIES:—The past year, 1923, the difference between the price of long staple and short staple cotton was very little, in fact staple cotton was a drag on the market. This caused a swing back to short cotton this (1924) year. This season there is about 6 cents difference in price in favor of staple cotton with a good demand for same. The closer price between short and long staple cotton, the more difficult it is to make selections, especially for the hill land varieties, as so much improvement has been made in staple varieties that in several instances they will produce as many pounds of lint per acre as the best short varieties. As a rule it is better to grow short staple varieties of cotton in the hill section and staple varieties on valley lands.

FERTILIZER TEST WITH COTON—1924

TABLE NO. THREE

Plat No.	FERTILIZER USED	Plat Yield Series 1	Plat Yield Series 2	Average Plat Yield	Average Acre Yield	Increase Over Check
1.	100 lbs. Nitrate Soda 200 Acid Phosphate	31.9	72.2	52.1	1042	174
2.	100 Nitrate Soda 200 Acid Phosphate 100 Kainit	37.4	74.8	56.1	1122	254
3.	Check	13.8	29.6	43.4	868	
4.	150 Nitrate Soda 200 Acid Phosphate	46.0	75.9	60.9	1218	350
5.	200 Nitrate Soda 200 Acid Phosphate	52.1	87.9	70.0	1400	532
6.	100 Nitrate Soda 75 Sulfate Ammonia 200 Acid Phosphate	51.4	86.5	68.9	1378	370
7.	50 Nitrate Soda 112 Sulfate Ammonia	52.5	77.5	65.0	1300	292
8.	Check	21.3	29.1	50.4	1008	
9.	200 Nitrate Soda 200 Acid Phosphate 100 Kainit	67.1	88.8	77.9	1558	550
10.	100 Nitrate Soda 75 Sulfate Ammonia 200 Acid Phosphate 100 Kainit	68.7	84.5	76.6	1532	524
11.	200 Nitrate Soda 300 Acid Phosphate	74.2	82.3	78.3	1566	434
12.	200 Nitrate Soda 300 Acid Phosphate 100 Kainit	79.5	83.0	81.3	1626	494
13.	Check	27.6	29.0	56.6	1132	
14.	200 Nitrate Soda 200 Potassium Phos.	76.9	78.8	77.9	1558	426
15.	200 Nitrate Soda 300 Potassium Phos.	77.5	76.8	77.2	1544	412
16.	200 Nitrate Soda 400 Potassium Phos.	76.2	75.9	76.0	1520	360
17.	200 Nitrate Soda 250 Acid Phosphate 100 Kainit	78.7	83.6	81.2	1624	464
18.	Check	27.3	30.7	58.0	1160	

TABLE NO. 3 (Continued)

Plat No.	FERTILIZER USED	Plat Yield Series 1	Plat Yield Series 2	Average Plat Yield	Average Acre Yield	Increase Over Check
19.	200 Nitrate Soda 250 Acid Phosphate	77.7	83.9	80.8	1616	456
20.	200 Nitrate Soda 250 Acid Phosphate 25 Sulfate Potash	78.1	82.5	80.3	1606	446
21.	200 Nitrate Soda 250 Acid Phosphate 50 Sulfate Potash	72.6	84.0	78.3	1566	400
22.	200 Nitrate Soda 250 Acid Phosphate 25 Muriate Potash	72.9	90.6	81.7	1634	468
23.	Check	26.5	31.8	58.3	1166	
24.	200 Nitrate Soda 250 Acid Phosphate 50 Muriate Potash	71.2	88.7	80.0	1600	434
25.	200 Nitrate Soda 250 Acid Phosphate	68.5	86.9	77.7	1554	388
26.	200 Nitrate Soda 250 Acid Phosphate 100 Kainit	70.8	92.0	81.4	1628	602
27.	200 Nitrate Soda 250 Acid Phosphate 25 Kemfert	76.1	88.4	82.2	1644	618
28.	Check	24.6	26.7	51.3	1026	
29.	200 Nitrate Soda 250 Acid Phosphate 50 Kemfert	69.1	84.2	76.6	1532	506
30.	200 Nitrate Soda 250 Acid Phosphate 50 Kainit	69.4	86.2	75.8	1516	490
31.	200 Nitrate Soda 250 Basic Slag 100 Kainit	68.6	83.7	76.1	1522	418
32.	200 Nitrate Soda 250 Acid Phosphate 100 Kainit	78.3	83.7	81.0	1620	516
33.	Check	25.0	30.2	55.2	1104	
34.	250 Nitrate Soda 250 Acid Phosphate 100 Kainit	81.2	92.8	87.0	1740	636
35.	300 Nitrate Soda 250 Acid Phosphate 100 Kainit	73.7	94.6	84.1	1682	578
36.	300 Nitrate Soda 400 Acid Phosphate 100 Kainit	88.9	95.5	92.2	1844	756
37.	300 Nitrate Soda 400 Acid Phosphate 200 Kainit	91.5	91.6	91.5	1830	722
38.	Check	25.7	28.7	54.4	1088	
39.	200 Nitrate Soda 250 Acid Phosphate	75.5	71.7	73.6	1472	384
40.	200 Nitrate Soda 250 Acid Phosphate 100 Kainit	80.3	70.3	75.3	1506	418

LOCATION:—East Finley Place.

SOIL:—Unimproved sandy valley land subject to damage by back water during heavy rains. No fertilizer has ever been used on the land.

VARIETY OF COTTON:—Mississippi Station Trice.

DATE OF PLANTING:—May 5th and 6th. Replanted skips May 22nd and 23rd.

SIZE OF PLATS:—1-20 of an acre each.

REMARKS:—This soil has been in cultivation for fifty or more years, was poorly protected from surface water and no fertilizer has ever been used. The land was broken about five inches deep, broadcast, two furrows thrown together, listing the land, the fertilizer applied on the list and covered by breaking out the middles. The land was harrowed ahead of the planter. More than half the plats were covered with back water from drainage ditch twice after cotton was up. All fertilizer was applied before planting the cotton.

CONCLUSIONS:—Nitrogen, Phosphorous and Potash all give good results. Nitrogen is more deficient than either Phosphorous or Potash. As the quantity of nitrogen is increased using a comparatively small amount of phosphorous and potash the yield of cotton is increased. See Plats 2-4-5-26 and 36. As to the requirements of phosphorous see Plats 7-11 and 19. As to the needs of potash see Plats 2-9-10-12-14-17-26-27-32-34 and 40. Kainit appears to be a satisfactory form of potash.

REMARKS:—Considerable uneveness has developed in the land used in this test. The plats through the center are on much better soil than the two edges. The extreme dry summer and fall has brought out this difference very perceptibly.

The plats are too small. This we felt was unavoidable on account of lack of desirable land on the farm to be used for this purpose.

This was the oldest cotton on the farm, and although planted twice, only a fair stand was secured. Rust developed in part of the plats and will, to some extent, account for low yields.

CONCLUSION:—Nitrogen and Phosphorous are both deficient in this soil, and Potash to some extent. We have not used enough nitrogen. The plat giving the highest yield of cotton 2075 pounds of seed cotton, was fertilized with 200 pounds acid phosphate, and 100 pounds nitrate of soda. The plat giving the highest increase over check or unfertilized plat, 549.5 pounds seed cotton was fertilized with 200 pounds acid phosphate ,100 pounds nitrate soda and 50 pounds kainit.

We wish to call special attention to plat fertilized with 100 pounds kainit. This plat gave 224.7 pounds seed cotton increase over the check. This plat was practically free from rust, the other plats around it rusted badly.

HOLLY SPRINGS BRANCH EXPERIMENT STATION

Co-Operative Fertilizer Tests

Conducted by the Holly Springs Branch Experiment Station in conjunction with County Agents and good farmers of this section.

All plats were selected, the fertilizer applied, and the cotton picked under the supervision of the Experiment Station, with the exception of

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FERTILIZER TEST UNDER COTTON—1924

SOIL:—Brown Loam valley land.

VARIETY OF COTTON:—Delfos 6102.

DATE OF PLANTING:—May 3rd, 1924.

SIZE OF PLATS:—1-43 of an acre each.

TABLE NO. IV

LBS. FERTILIZER USED	Series 1 Yield Per Acre	Series 1 Incr. Over Check	Series 2 Yield Per Acre	Series 2 Incr. Over Check	Average Increase over chk.
200 Acid Phosphate	1296.5	268.0	1642.2	86.5	177.3
400 Tenn. Phosphate Rock	1106.3	77.8	1624.9	69.2	73.5
400 Florida Soft Rock	1331.0	8.6	1624.9	69.2	38.9
200 Duplex Phosphate	1417.5	95.1	1642.2	86.5	90.8
100 Kainit	1616.2	224.7			224.7
250 Cottonseed Meal	1607.6	216.1	1218.7	85.1	155.6
100 Nitrate Soda	1866.9	319.8	1244.6	121.0	220.4
200 Tankage	1650.8	103.7			103.7
100 Cyanamid	1452.0	233.3	1460.7	103.7	168.5
75 Sulfate Ammonia	1374.3	155.6	1417.5	60.5	103.1
50 Nitrate Ammonia	1175.6	103.9	1339.7	69.2	86.6
200 Dried Blood	1166.8	95.1			95.1
25 Nitrate Ammonia 37½ Sulfate Ammonia	1512.5	121.0	1331.0	60.5	90.8
50 Nitrate Soda 125 Cottonseed Meal	1590.3	198.8	1296.5	172.9	185.9
50 Nitrate Soda 100 Tankage	1806.4	267.9			267.9
Soak Seed in Ni. So. Sol. 50 1st Working 50 July 1st	1892.8	354.3	1227.3	103.7	229.0
250 Cottonseed Meal 200 Acid Phosphate	2039.7	242.0	1331.0	146.9	194.5
100 Nitrate Soda 200 Acid Phosphate	2074.3	276.6	1538.5	354.4	315.5
200 Tankage 200 Acid Phosphate	1624.9	302.5	1097.7	103.7	203.1
50 Nitrate Soda 37½ Sulfate Ammonia			1313.7	190.1	190.1
75 Cyanamid 200 Acid Phosphate	1434.7	112.3	1624.9	207.4	159.9
75 Sulfate Ammonia 200 Acid Phosphate	1210.0	95.1	1564.4	146.9	121.0
200 Dried Blood 200 Acid Phosphate	1391.5	276.6			276.6
100 Nitrate Soda 400 Tenn. Phosphate Rock	1599.0	103.8	1382.9	224.7	164.3
100 Nitrate Soda 400 Florida Soft Rock	1590.3	95.1	1322.4	172.9	134.0
100 Nitrate Soda 200 Duplex Phosphate	1469.3	164.2	1417.5	250.7	207.5
100 Nitrate Soda 200 Acid Phosphate 50 Kainit	1875.5	570.4	1685.4	518.6	549.5

the last picking of Series 2 at Amory; Mr. Rogers vouches for the correct weights of this picking.

The plats at Amory were on the farm of Rev. Jeff A. Rogers. Mr. McInnis, the County Agent, assisting in this work. This land has been in cultivation for over seventy-five years without the use of commercial fertilizer. Similar tests were made at Nettleton and Booneville, Miss., the past two years with practically the same results. The soils on which these tests were made were table land, slightly rolling clay loams.

The plats at Olive Branch were located on the farm of Mr. M. H. White, with E. C. Mingee County Agent, assisting. This is the third year with this work at Olive Branch. Mr. White has his farm terraced and is a liberal user of cow manure and winter cover crops to keep up soil fertility. The land on which these tests were made has had applications of manure prior to these tests. This to some extent will account for the comparative small increase in yields from the use of fertilizers when we take into account the seasons we have had in the past three years. This soil is a typical Brown Loam of this section.

TABLE NO. 5.

Table showing results of "Cooperative Fertilizer Tests conducted at Olive Branch, Amory and Ingomar.

Kind and Quantity of Fertilizer Used	Olive Branch			Amory			Ingomar		
	Avg. Yield 2 Series Per Acre	Value Seed Cotton at 8c	Increase Over Check Plat	Avg. Yield 2 Series Per Acre	Value Seed Cotton at 8c	Increase Over Check Plat	Avg. Yield 2 Series Per Acre	Value Seed Cotton at 8c	Increase Over Check Plat
100 lbs. Nitrate S.	969	$77.52	$ 5.32	712	$56.96	$13.96	728	$58.24	$20.23
200 lbs. Acid Phos.	966	77.28	5.08	547½	43.80	.80	678¾	54.29	16.28
200 lbs. Acid Phos. 100 lbs. Nitrate S. 100 lbs. Kainit	1109	88.72	16.52	835	66.80	23.80	842	67.37	29.36
200 lbs. Acid Phos. 100 lbs. Nitrate S.	985	78.80	4.80	715	57.20	21.00	849¾	67.97	24.89
150 lbs. Acid Phos. 100 lbs. Nitrate S. 75 lbs. Kainit	1077	86.16	12.16	800	64.00	31.00	803¾	64.29	21.21
150 lbs. Acid Phos. 100 lbs. Nitrate S. 100 lbs. Kainit	1047	83.76	16.40	782½	62.60	22.40	859½	68.77	24.74
250 lbs. Acid Phos. 100 lbs. Nitrate S.	970	77.60	10.24	852½	68.20	28.00	842½	67.41	23.38
250 lbs. Acid Phos. 100 lbs. Nitrate S. 100 lbs. Kainit	1011	80.88	17.44	765	61.20	29.60	915½	73.24	20.45
300 lbs. Acid Phos. 150 lbs. Nitrate S.	938	75.04	11.60	785	62.80	31.20	925	74.00	21.21
300 lbs. Acid Phos. 150 lbs. Nitrate S. 100 lbs. Kainit	1100	88.00	21.04	855	68.40	39.00	888	71.03	30.47
300 lbs. Acid Phos. 200 lbs. Nitrate S.	1027	82.16	15.20	897½	71.80	42.40	988½	79.09	38.53
300 lbs. Acid Phos. 200 lbs. Nitrate S. 100 lbs. Kainit	1022	81.76	14.80	947½	75.80	46.40	1011¼	80.90	40.34

The plats located at Ingomar on the Pontotoc Ridge were on the farm of Mr. R. H. Hitt. This is typical of the original soil of this section, chocolate colored loam. Mr. W. C. Mimms, County Agent, assisted in this work. This soil was slightly rolling and somewhat irregular in fertility. This is our first year with results in the Pontotoc Ridge section. Taking everything into consideration, we can see but little, if any, difference in the requirements of any of the soils in the hill section of North Mississippi. This statement is not intended to include the lime hill lands of East Mississippi, on which we have not conducted experiments. We think the above statement applies to the hill section of Central Mississippi as far south almost as McComb City. The soils are very similar throughout this section of the State.

All plats used in these fertilizer tests were one-twentieth of an acre in size and are duplicated in each instance. A check row was left between each plat, with every third plat a check or unfertilized plat.

Date of planting at Olive Branch—May 30. First planting failed.

Date of planting at Amory—April 27. Replanted by hand May 9th.

Date of planting at Ingomar—April 25.

REMARKS:—The wet cold spring was very unfavorable for cotton. Securing a perfect stand was almost impossible. The stands at Amory, Olive Branch and Ingomar were only fair.

All plantings are in duplicate and are designed as Series 1 and Series 2. Series 2 was opposite Series 1 and on continuous rows. In the second series, the plats were reversed from what they were in Series 1, that is, Plat 17 in the second series was opposite Plat 1 in the first series and on continuous rows. Plat 16 of the second series was opposite Plat 2 in the first series, and so on.

BOLL WEEVIL DAMAGE:—There is no question but that the extreme cold weather of winter killed the greater part of the weevils in this section. This followed by the extreme dry hot weather made the weevil damage very light.

CONCLUSIONS:—The use of Nitrogen in all of these soils was very beneficial, as the quantity was increased, using sufficient amount of Phosphorous and Potash, the crop was increased. From results at the Station this year we do not feel that we have reached the maximum amount of Nitrogen that could be used to profit in these sets of plats. In Plat No. 2 at Amory, acid phosphate gave practically no results, this does not mean that the soil had a sufficient amount of phosphorous in it to make a large crop, but that there was enough there to balance the nitrogen and potash present. Nitrogen was the limiting factor. See results in Plats 5-10-13 and 16. Both nitrogen and phosphorous are deficient.

Indications are that potash in small applications is also beneficial. We call attention to the Amory Plats again, see Plats 4-7-8-11-14 and 17 Similar results can be seen in the same numbers given in the Plats at Olive Branch and Ingomar.

The use of fertilizer can be compared to a chain with three links, one link to represent phosphorous, one nitrogen and one potash. The strength of any chain is the weakest link. Where small quantities of nitrogen and phosphorous are used there appears to be a sufficient amount of potash in the clay soils of this State to give a good increase. Where larger amounts of nitrogen and phosphorous are to be used it is advisable to use a small quantity of potash. No one will ever make a pound more of corn or cotton than the available potash will allow.

Taking into consideration results at various places in North Mississippi

and our results at the Station,—there is no marked difference as to the fertilizer requirements in any of the several sections of North Mississippi. The out-standing fact is that both nitrogen and phosphorous are deficient, and potash to some extent, and that a moderate amount of a complete fertilizer rich in nitrogen increases the yield of cotton very materially.

Taking into consideration these results and those of the Station for the past several years, we recommend for average conditions (an ordinary tenant) the use of 200 pounds of acid phosphate, 100 pounds of nitrate of soda and 100 pounds kainit mixed per acre, or its equivalent in a mixed fertilizer composed of eight per cent phosphorous, four per cent nitrogen and three per cent potash at the rate of 400 pounds per acre (8-4-3). Where good farming is to be done, use 300 pounds acid phosphate, 200 to 250 pounds nitrate of soda and 100 pounds kainit or an increased amount of the mixed fertilizer.

COTTON SPACING TESTS—1924

Hill Land Spacing Test.

Soil:—Brown Loam table land.

Plats:—1-3.89 of an acre and 3 1-2 foot rows.

Variety:—Selection of Wannamaker Cleveland.

Fertilizer:—A mixture of 200 pounds acid phosphate, 100 pounds nitrate of soda and 100 pounds of kainit used at the rate of 500 pounds per acre.

Planted:—May 6, 1924.

Valley Land Spacing Test. Plats:—1-5.52 of an acre each.

Soil:Brown Loam valley land. Variety:—Delfos 6102.

Fertilizer:—Same as above on hill land plats.

Planted:—May 19, 1924.

HILL SPACING TEST—TABLE NO. 6

Plants per Foot in Drill	Yield in lbs. Seed Cotton per Acre
2.85	1077.1
2.33	1111.8
1.55	1089.6
1.17	1088.8
.86	1084.0
.72	1114.5

VALLEY SPACING TEST—TABLE NO. 7

Plants per Foot in Drill	Yield in lbs. Seed Cotton per Acre
3.31	2575.6
2.04	1657.7
1.77	1604.1
1.12	1514.1
.95	1516.3
.75	1345.8

REMARKS:—Cold wet weather caused a second planting in the valley and retarded growth of all cotton.

An attempt was made to use the following spaces in the row; unthinned, to be left as it came from the planter, three stalks in bunches per foot, two stalks per foot, one stalk per foot, one stalk per eighteen inches and one stalk per twenty-four inches.

The above tables give the average space per foot which was obtained by actual counts.

On the hill test there were three series of plats used. On the valley test two series of plats were used.

In the hill test there is a slight variation in the fertility of the soil, but this is not true on the valley test. It should be remembered that there was but little weevil damage this year and the length of the growing season was normal.

CONCLUSIONS:—With the use of a proper balanced fertilizer, we recommend for valley land 3 1-2 foot rows and from two to three stalks in bunches per foot. On hill land, three foot rows and from three to four stalks per foot. We believe to block out the cotton leaving sufficient space between each block to be able to get the grass easily is not far from good spacing.

CORN

The average yield of corn on the Station farm this year was between forty-five and fifty bushels per acre. Some thin spots cut down the yield. All of the corn grown is after some legume, principally vetch. As a rule, early planting on thin land is advisable. The seasons are more favorable about the time corn begins to fruit than they are when later plantings are made. When plantings are made earlier than the latter part of April, the results are usually a poorer stand. When the soils have an abundance of vegetable matter earlier plantings can be made with safety. Thin land is a poor place to grow corn. Corn is one of the crops that will tell you by the yield the kind of land on which it is planted. Our method is to turn the land planted to crimson clover about the time blooming begins. Disk the land thoroughly and after a rain, harrow and plant on a level. On land where vetch is grown, after some of the seed have matured, the vetch is removed for hay and the land turned, disked, harrowed, and planted. Usually land in vetch has sufficient moisture in it to permit immediate planting after preparation. The planting should follow very closely to preparation. One good rain after the land is turned to settle down the soil, almost insures a good crop of corn. This work is done usually the first half of June.

We advise planting beans, Otootan or Laredo soy beans, in every row of corn. If it is a dry year, the yield of corn will be reduced to some extent, but the two crops are much more valuable than corn alone. It is a good practice to plant two rows of corn and one row of velvet beans. If the same number of stalks are left on the two rows of corn as would be left if all three rows were planted to corn, the yield will be reduced but little. This method will build up the land and at the same time give larger yields each year from the land. The Laredo or Otootan soy bean will stand more water than corn. Unsafe wet lands can be planted to either of these beans and corn and if the corn is drowned out the beans will make a crop. Much of the wet lands of the country are being planted to one of these varieties of beans for forage. Beans planted in the same row with corn will keep down weeds and grass to some extent and shade the ground during the summer. Three or four beans dropped every twenty-eight or thirty inches will give satisfactory results. If necessary a planter dropping the beans can be run behind the corn planter in the same row with the corn. If corn is not planted until after damage of frost, the beans will germinate about as well as the corn.

PLANTING AND CULTIVATING:—Corn should be planted very shallow in the spring and on a well prepared seed bed. We prefer wasting seed corn in order to insure a good stand. About seventy-five per cent of the

farmers do not put down enough seed to insure a stand of corn. Where a forty-two inch row is used, on average land, one stalk every thirty inches is about the right distance. As land increases or decreases in fertility, the distance should vary. The more fertile the land the more closely the corn can be grown and the thinner the land the wider the distance should be. It is easy to leave too much corn in the land for the best results. Thin land should be planted to a legume and not to corn, more feed will be secured by such a method.

Where deep cultivation is practiced it should begin when the plants are small and should be kept up at frequent intervals. This method is more applicable for early plantings. For June planting, medium shallow cultivation is advisable. Four or five cultivations on the later plantings are usually sufficient for good results. Run the cultivator about the same depth at each cultivation regardless of the method used.

VARIETY CORN TEST

Soil:—Valley land.

Plats:—One row each planted in checks, repeated six times. Rows or checks are 3 1-2 feet apart.

Date of Planting:—May 16, 1924.

Fertilizer Used:—Two hundred pounds of acid phosphate and 150 pounds of nitrate of soda, after turning under a good sod of crimson clover. This land is capable of producing double the quantity of corn. Moisture was the limiting factor.

TABLE NO. 8

No.	Variety Used	Yield in Bus. Shelled Corn Per Acre	Yield in Lbs. Ear Corn Per Plat	Per Cent of Grain	Size of Plats On Acre Basis	Rank
1.	Williamson	47.88	227	76.4	1-15.46	[illegible]
2.	Biggs Seven Ear	47.07	222	76.4	15.54	[illegible]
3.	Whatley	50.05	228	75.0	16.39	11
4.	Mosby, Station	50.35	240	77.8	15.10	10
5.	Mosby, Delta	56.46	260	78.5	15.49	7
6.	Mosby, Lee	47.60	227	77.1	15.23	16
7.	Mosby, Harpeth	48.27	218	76.4	16.23	14
8.	Cocke's Pro., Station	56.70	287	76.4	14.48	6
9.	Cocke's Pro., Delta	51.97	249	77.1	15.16	9
10.	Hastings	43.02	250	76.4	15.23	19
11.	Laguna	49.93	258	75.0	14.45	12
12.	Mexican June	46.50	225	75.0	15.43	18
13.	Tenn. Red Cob	59.39	276	77.1	15.63	4
14.	Paymaster	68.77	318	79.2	15.29	1
15.	Ellis	48.28	218	73.6	16.85	13
16.	Delta Prolific	65.00	279	77.8	16.77	3
17.	Yellow Dent	54.60	227	77.1	17.47	8
18.	Large Golden Dent	58.14	276	75.0	15.73	5
19.	Jellicourse Twin	66.81	318	77.1	15.26	2

REMARKS:—Cultivation was shallow. The variety giving the highest yield was Paymaster with 68.7 bushels per acre. This variety has given the highest yield at this Station for the past several years. Jellicourse Twin, a variety secured from Knoxville, Tennessee, Experiment Station, came second. This is a tall growing variety similar in type of ear to Mosby.

RECOMMENDATIONS:—Neal's Paymaster, Delta Prolific, Tennessee Red Cob, Mosby, Cocke's Prolific and Large Golden Dent .

FERTILIZER CORN TEST—1924

Soil:—Brown Loam valley land.

Planted:—May 20, 1924.

Plats:—1-13.53 of an acre in size.

Variety:—Neal's Paymaster.

The land was broken broadcast and the fertilizer applied in an open furrow and covered by two furrows with a small turning plow and harrowed flat. Nothing is lost in thorough preparation of the soil for corn.

TABLE NO. 9

Plat No.	Fertilizer Used	Acre Yield in Bushels
1.	100 lbs. Nitrate Soda	74.6
2.	100 lbs. Nitrate Soda 200 lbs. Acid Phosphate	75.4
3.	Check	78.5
4.	150 lbs. Nitrate Soda	90.4
5.	200 lbs. Nitrate Soda	87.8
6.	100 lbs. Nitrate Soda at Planting 100 lbs. Nitrate Soda 1st Working	94.9
7.	Check	82.3
8.	200 lbs. Nitrate Soda 200 lbs. Acid Phosphate	93.6
9.	100 lbs Nitrate Soda at Planting 200 lbs. Acid Phosphate at Planting 100 lbs. Nitrate Soda 1st Working	85.1
10.	Check	70.1

REMARKS:—This corn had too much rain in the early part of the growing season and not enough at fruiting time and the latter part of the growing season.

CONCLUSIONS:—Moisture was the limiting factor. There was enough nitrogen and phosphorous present to make a good yield. It appears that both nitrogen and phosphorous were to some extent beneficial. The plat on which 200 pounds of acid phosphate, 100 pounds nitrate of soda applied at planting and 100 pounds of nitrate of soda applied at the first working gave the highest increase of 115 bushels or a total yield of 85.1 bushels of corn per acre. The highest plat yield per acre was where 100 pounds of nitrate of soda was applied at planting and 100 pounds at first working, giving a yield of 94.9 bushels per acre. With the small cost of acid phosphate per acre and on land of this type, it is advisable to use a small quantity of acid phosphate to be sure of a balanced fertilizer unless liberal applications of phosphorous were used on previous crops.

RECOMMENDATIONS:—Use 150 pounds of acid phosphate and 100 pounds of nitrate of soda at planting. It will pay in most instances to use from 50 to 100 pounds of nitrate of soda as a side dressing after first working or the full amount of nitrate of soda may be used at planting.

Very frequently side dressings of nitrate of soda are made too late for the best results. It is very hard to find the time to make side applications of fertilizer. In most instances it is advisable to apply all the fertilizer to be used prior to seed planting.

CORN AND BEAN TEST—1924

The first planting of corn and beans failed to produce a good stand and a later planting was made June 19th. The plats were 1-12.35 of an acre in size and on a hill side of ordinary fertility. The dry weather that followed closely after planting will explain the low yields.

TABLE NO. 10

METHOD OF PLANTING	Yield in Bus. per Acre 1923	Yield in Bus. per Acre 1924
1. 6 Rows Corn and Lareda Soy Beans	45.5	26.9
2. 6 Rows Corn and Velvet Beans	31.3	36.4
3. 6 Rows Corn	48.2	52.8
4. 6 Rows: 2 Rows Corn to 1 Row Soy Beans	42.5	34.7
5. 6 Rws: 2 Rows Corn to 1 Row Velvet Beans	40.2	37.6

REMARKS:—These results are unusual. There is some variation in soil fertility. In Plat No. 1, the soy beans made excellent growth and there was not enough moisture for both beans and corn.

Plat No. 2—The velvet beans did not make a very satisfactory growth, this gave the corn a greater supply of water, enough to make ten more bushels of corn per acre. In Plat No. 3, the corn had full sway and made to the limit of the water supply.

CONCLUSIONS:—Plant beans in corn, either in every row or in every third row. The two crops will more than equal corn alone. It is not advisable to plant velvet beans in every row with corn, a wet year the beans will destroy the corn. A season when the rains are plentiful the yield of corn will not be reduced but little even if soy beans are planted in the same row with corn. In our results of 1923, there was only about three bushels difference in yield in favor of the corn without the soy beans. This method will keep up soil fertility besides giving an increased amount of forage and grain from the land.

SILAGE:—Sweet sorghum alone is used for silage on the Station. We have found Japanese Seeded Ribbon Cane very satisfactory. This sorghum produces at least one-third more tonnage per acre on thin or fertile land than corn and is nearly as valuable ton for ton as corn silage. Sorghum has other advantages. Dry seasons like the past year, sorghum will stand the drouth better and at harvest time the sorghum will not damage if harvesting is delayed. Corn silage has to be harvested at an exact stage or the quality of silage deteriorates. Corn blooms but once and if the weather is unfavorable during this period the results will be a poor yield—without grain on the corn silage would be very poor. Sorghum will wait for rain and will recuperate after the rain. The one thing to be guarded in sorghum, it must be mature to make a good grade of silage. Immature sorghum will make sour silage, which is very undesirable. The past year we planted sorghum with a corn plate in the planter, which dropped the seed in bunches. We did not use a hoe in cultivation but depended alone on the cultivator to control the weeds and grass. Sorghum grown thick in this way will produce smaller stalks which are more desirable for feed. As a fertilizer we used 300 pounds of acid phosphate, 250 pounds nitrate of soda, and 100 pounds of kainit in the drill under the seed. A side dressing of nitrate of soda at the rate of 100 pounds per acre was applied when the weather began to get dry. Sufficient silage was made this year on the farm to meet all demands with an unprecedented dry year. All of the silage grown on the Station is after vetch or vetch and oats. This puts the harvesting season about the middle of October. A normal season on fertile soil, fifteen tons of sorghum per acre could be expected. We have produced twenty tons per acre on our best land. Some have found very satisfactory planting corn and sorghum in the same row on good land. The late varieties of sorghum will mature with the corn. This mixture is considered a desirable one. Others grow the crops separately and affect a mixture at the cutter. This is easily done by first cutting a load of one and then a load

of the other. By putting the average yield of silage at ten tons per acre, one acre of silage will feed four cows five months giving about thirty pounds of silage per day as a filler. We have been unable to find a substitute that is more profitable.

SWEET POTATO VARIETY TEST—1924

Soil:—Brown Loam valley land.

Planted:—June 12, 1924.

Fertilizer Used:—300 pounds acid phosphate, 150 pounds nitrate of soda and 100 pounds of kainit.

The table below gives an average yield for the past four years.

TABLE NO. 11

No.	Variety Used	Average Yield In 1921	Average Yield In 1922	Average Yield In 1923	Average Yield In 1924	Four Years Average Yield in bus.
1.	Nancy Hall	198.7	150.4	142.9	217.3	177.3
2.	Triumph	271.8	178.8	195.2	224.5	217.6
3.	Porto Rican Yam	278.8	191.4	133.3	135.2	184.7
4.	Dooley Yam	200.2	125.1	177.1	178.6	170.2

SWEET POTATO SPACING TEST—1924

TABLE NO. 12

No.	Space Used	Yield per Acre in Bushels
1.	8 Inches in drill	199.5
2.	16 Inches in drill	169.1
3.	24 Inches in drill	110.4

REMARKS:—In the four year average given in the table above, of the leading varieties grown in the State, Triumph gave the highest yield, 217.6 bushels per acre. This is a white skin and white flesh, rather large, early maturing variety. Stands well in some markets. It is a large growing variety and is grown to a considerable extent in the southern part of the country for late summer and early fall marketing. This variety is hardy, very free from diseases and an excellent keeper.

PORTO RICAN YAM:—A red skin, yellow flesh variety came second in yield giving an average of 184.7 bushels for the past four years. For some reason we cannot explain, this variety gave a very low yield this season in comparison with what it usually does. This variety is growing in popularity in the markets and is destined to be one of the leading marketing varieties. The plants are hardy and exceptionally free from diseases.

NANCY HALL:—A golden yellow skin and flesh potato. This is probably the most universally grown variety in the South. It is the standard variety and is known in all markets. This variety was a little lower in yield, 177.3 bushels per acre for the four year average. If it is properly cured in curing houses; it eats very similarly to the old sugar yam or common yam.

In the spacing test the Porto Rican Yam was the variety used. The yields are disappointing. With the high price potatoes are selling at this fall it looks as if it would pay to use the eight inch spacing in the row. From results obtained in previous experiments, we recommend three to three and one half foot rows and plants 14 to 16 inches apart in the row.

SEED SELECTION AND TREATMENT:—Use only clean sound potatoes free from disease. Potatoes grown from vine cuttings on land free from diseases give the most desirable potatoes for growing plants. We have selected sound potatoes from those badly infested with black rot. By treating these potatoes for ten minutes in a solution composed of one ounce bichloride of mercury to eight gallons of water, perfectly clean plants

were grown. It is advisable to treat all of the seed potatoes, before bedding, in the above solution regardless of how clean they may be.

BEDS:—Convenience for watering has much to do with the location, also the beds should be on land where no potatoes have been grown for the past five years. If a sloping hill side can be had, begin at the bottom of the slope and move the beds up the hill each year. If it becomes necessary to use the same beds each year, the soil should be removed and all parts of the bed disinfected with a solution of copper sulphate, one pound to twenty gallons of water. A wooden vessel should be used in making this solution. We make our beds about five feet wide with a six foot walk between. Elevation for drainage is made by removing six inches of soil from the walkway and putting it on the bed. The potatoes are placed close together without touching and are covered with woods dirt or clean bank sand. This covering is usually about 2 1-2 inches deep. Where early plants are desired, frames should be made and covered with canvas. Also bottom heat will be necessary. This heat can be supplied from a hot bed made of green stable manure or from a furnace or some other method. A common method is to dig a trench a little over one spade wide and a spade deep. This trench should be in the middle of the bed and should have a rise of not less than one foot in twenty-five feet of length. The lower end of the trench is widened out and deepened to be used as a furnace. Old tin or sheet iron is placed over the trench the entire length and six inches of soil is put on the sheet iron. The potatoes are bedded as described above. A chimney made of one by twelve plank six or eight feet high should be placed at the upper end. When desired, fire is made in the furnace and the bed is heated. The advantage of using this kind of heat is that it can be supplied only when necessary.

Most of the diseases common to the sweet potato start in the seed bed. Every care should be used to prevent this infection. The best results are obtained where the location for both the beds and fields are changed each year with at least five years intervening between crops of potatoes if there was any infestation.

SOIL FOR PLANTING:—There is a common belief among farmers that thin soil is the place to grow potatoes. We have never seen the crop that gives better results when grown on thin soil in preference to a fertile one. and the potato is not an exception . It is true that some potatoes can be grown on thin soil but a much larger yield can be had from the better type of land. A clay or sandy loam is fine for potatoes. Most of the Station potatoes are grown after vetch is harvested from the land. After the crop of potatoes is harvested the land is harrowed and allowed to come up in vetch. If the winter is mild, this late volunteer vetch will survive the winter weather. Make rows three to three and one-half feet apart. Plants put out early in June and give good yields. Set plants from fourteen to sixteen inches apart in the row. Use 300 pounds of acid phosphate, 150 pounds of nitrate of soda and 100 pounds of kainit per acre. To freshen up the land just before planting is a good practice.

HARVESTING POTATOES:—A hay rake will assist greatly in removing the vines. Two furrows with a double horse plow does good work in the absence of a potato digger. The greatest care should be used to prevent bruising. The potatoes should be assorted in the field and placed in baskets or boxes. This will facilitate handling and curing out in the curing house. It is through bruised or cut potatoes that diseases such as ring rot, storage rot. and other diseases are introduced. Such potatoes should be stored separately or disposed of otherwise.

The storage house should be thoroughly sprayed on the inside a week

or more before the potatoes are dug. A solution of copper sulphate, one pound to twenty gallons of water will destroy infection.

CURING THE POTATO:—To ged rid of the excessive water in the potato is the next process. It the weather is dry open all ventilators, doors and windows and allow air to circulate during the day and close up at night. Keep fire going in the furnace or stove during the day. It usually requires two weeks to dry out small houses. The thermometer should register 75 or 80 degrees during the days to get the best results in curing the potatoes. Properly cured potatoes will stand four or five degrees below freezing without great damage, which is an item in marketing. The proper temperature for keeping houses during the winter is between 45 and 55 degrees, slight variations will not injure the potatoes.

VETCH

In our variety plantings of vetch we got but little this year on account of the extreme wet spring. Hairy vetch is the best variety we have found so far. We believe that vetch is one of the most valuable winter cover crops for this section; probably not any more valuable than bur clover after the land is properly seeded, but the ease in which it is secured and its value as a hay gives it first place.

The hope of Southern agriculture is increased production; this can only be had by increased soil fertility. The cheapest way to increase soil fertility is by growing legumes. When land is once seeded to vetch it immediately becomes a volunteer winter leguminous cover crop and works nicely with the growing of such crops as sorghum, corn, sweet potatoes, soy beans, cotton and other crops. Sow about fifteen pounds of seed on a good soil about the first of September and cover by using a cultivator. Land on which manure has been scattered gives fine results. Use about one half pound of soil from land growing vetch successfully to each pound of seed to furnish inoculation. If let alone vetch will mature seed about the latter part of May. The first crop should be turned under after seeding to secure a good quantity of seed for future crops. After the first year a hay crop can be removed after some of the seed have matured.

We have found the following two year rotation a most excellent method: Plant vetch seed, fifteen pounds per acre, in cotton middles in September and cover by using a cultivator of some kind. When fall rains begin the vetch will germinate and do some growing during the winter. Allow this to mature seed, turn the land and plant to corn, which will be in June. Plant the next year to cotton and allow the vetch to mature seed, follow with corn etc. Land treated in this way will increase in production each year. A small addition of about two tons of limestone per acre will double the yield of vetch. The manure secured from stock fed to vetch hay if scattered on the land will give a most excellent seeding of vetch. This is one of the easiest ways to increase the area on the farm. We cultivated land this year that was seeded to vetch sixteen or seventeen years ago and now has a most excellent stand. Only one seeding has been made. This land will now make two bales of cotton and one hundred bushels of corn a good year for these crops. Vetch does not do well on a wet soil or in a wet spring. It is necessary to keep up the supply of phosphorous and potash to get the best results following vetch.

LESPEDEZA

Forty plats were planted to lespedeza this spring using various quantities of seed and different mixtures of fertilizers. The dry summer and fall destroyed the value of this test. It is advisable to use not less than one bushel of seed per acre. If grown for hay, one and one-half bushels of seed

would give better results. Many of our friends have not fully realized what they have in this plant. Lespedeza is one of the greatest legumes ever grown in this country. This plant adapts itself to any kind of soil from the poorest to the richest and seems to thrive best on fertile sour soils. Where land is too poor to grow a profitable crop of any kind it should be seeded to lespedeza and let alone for a few years. When gullied land is graded and all the surface soil gone, the only plant that we have found that will make any growth of consequence is lespedeza. There is enough idle land growing lespedeza in the State to furnish sufficient hay to feed all of the livestock in the State if harvested each year. There is no better quality of hay known. In previous tests with fertilizers, 500 pounds of acid phosphate doubled the yield of hay. Like all other plants it does best on rich land. It is a common practice to sow fall oats and the latter part of March, section harrow the oats and seed to lespedeza. After the oats are harvested the lespedeza will take charge and produce a good yield on fertile soil. Some sections of the State are growing lespedeza seed for the market as their principal industry. The seed sell from $3.50 to $6.00 per bushel. The poorer types of soil are used for seed production. From seven to ten bushels of seed per acre is considered a fair yield.

Every acre of idle land in the South should be seeded to lespedeza as a soil restorer if for nothing else. It would not require soil preparation. A few seed scattered here and there over the farm would soon be scattered over the entire farm.

The common method of preparing land for seeding to lespedeza is to disk the land diagonally across the rows and run the section harrow at right angles to the disking. This will about level the land. If a large area is to be seeded this harrowing can be done at any time in the early spring. The seed should be sown on freshly harrowed soil the latter part of March and should not be covered. The weeds and grass should be clipped with a mower once or twice during the year to give the lespedeza advantage.

There are several attachments or seed pans on the market used in catching the seed in harvesting. A greater part of the seed on the market are harvested in this way. After a light frost in the fall, the seed shatter out easily and are caught in this pan which is attached to the rear of the cutter bar of the mower. Many seed are saved from pasture lands where the plants have made but little growth.

ALFALFA:—In our variety test we only secured one good cutting. The second cutting was very light. The fertile clay uplands of this section will grow alfalfa without any trouble if four or five tons of crushed limestone per acre is applied to the land in the fall and harrowed in. When the weather is suitable, fall planting (September) is the best time to plant. Common or native grown alfalfa is as good a variety as we have found. One or more acres near the home for hogs and poultry to furnish early grazing will be found profitable. Lespedeza is the alfalfa of the South.

FORAGE CROPS

SOY BEANS:—The two most valuable varieties of soy beans we have so far grown on the Station are the Laredo and the O-too-tan. The two varieties are very similar in growth and the seed are small and look very much alike, black in color and could be easily mistaken for other varieties. The principal difference in these two varieties is in the length of time in maturing seed. The Laredo is two or three weeks earlier in maturing than the O-too-tan and does not make quite as heavy a growth. We have discarded growing cow-peas altogether on the farm and have substituted soy beans instead for growing with corn or for forage. As a forage crop the O-too-tan

bean will produce from two to three tons per acre of the most excellent hay. Both of the varieties are abundant fruiters. It requires about one and one-half gallons of seed to plant an acre. Seed planted in three foot rows give good results. An application of 200 pounds of acid phosphate per acre under the seed will be profitable. Two cultivations early in the season are sufficient. The Delta section of the State is very much interested in the Laredo bean. The opinion of some is that the Delta will almost discard the use of cow-peas as soon as the supply of Laredo bean seed can be had. Seed growers should note this statement. They want a forage crop that can be harvested before cotton picking begins. Either of the two varieties make splendid growth on soils too wet for other crops to be grown profitably. This fact when put into practice will enable thousands of acres of here-to-fore unprofitable lands to be made as profitable as any lands of the farm. There is another distinctive value these two varieties of beans have: the beans that shatter out in harvesting, if disked in, will come up the following spring and produce a volunteer crop of beans. In many cases after the beans are harvested in the fall, oats are disked in and at the same time covering the beans that were shattered out in the harvesting. When the oats are harvested in June, the volunteer beans take charge of the land and make a wonderful crop. We have twenty-five acres of land in oats following Laredo beans at present. These two varieties do not shatter out very much in harvesting. They are generally cut with a mower, raked and hauled as other hay and later on threshed. There are several horse drawn threshers on the market that do good work by threshing the beans standing on the row in the field. It will be well for those growing seed beans to investigate these machines. The hay would be lost in this instance but many more seed would be saved per acre and also much labor saved. I am sure the soil will be benefited by the addition of the bean vines. Twenty-five or thirty bushels is not an uncommon yield of these beans per acre.

The Biloxi soy bean is a very tall growing, heavy yielding variety. The stems are rather coarse but make an excellent quality of hay. The beans of this variety are red in color and larger than the Laredo bean. This is a late maturing variety. We have grown Biloxi beans six feet tall. To secure seed early planting is necessary.

YELLOW MAMMOTH'—This has been the standard for hay and hogs for some time. We find it hard to get a stand of this bean, much harder than any other variety. The beans shatter out easily if ripe at harvesting. The beans make a fine quality of oil when crushed out and the flesh of the bean is almost as valuable as cotton-seed meal for stock feed. There is no excuse for any Southern farmer to have to buy hay.

APPLES

There is no section of the country better suited to grow apples than the lands of North Mississippi. The soil and climate are both ideal. On good soil the trees grow fast and bear early. The fruit is well colored and of high quality. If proper care was given, apples could be grown profitably anywhere in this section. We have some trees nineteen years old that bore from fifteen to twenty bushels per tree this year. There are apple trees scattered over this end of the State that are over fifty years old still bearing a good crop every year. These old trees have not been sprayed or pruned, but have been left alone to take what came. Our orchard is on what might be termed valley land. When planted the land was almost depleted of vegetable matter. Many of the varieties planted were not suited to these soils or were diseased and were taken out. It will be useless to attempt to grow apples without proper spraying.

Bulletin 224 December, 1924

REPORT

Raymond Branch Experiment Station

1923 and 1924

By

C. B. Anders

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

STATION STAFF

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J. R. Ricks, M. Sc. ..... Director and Chief in Agronomy
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D. W. McIlwain ..... Superintendent of Farm
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B. V. Evans ..... Farm Foreman, South Miss. Branch Station
J. C. Ryan ..... Farm Foreman, Holly Springs Bran h Station
J. C. Peyton ..... Farm Foreman, Raymond Branch Station
K. C. Livingston ..... Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. ..... Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. ..... Collaborator
E. C. Ewing, M. Sc. ..... Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

Report of The Work at the Raymond Branch Experiment Station

By C. B. Anders

INTRODUCTION

This report contains a summary of the results of the more important experiments conducted here during the seasons 1923 and 1924. It does not contain all the results obtained here, as many of the tests have not progressed far enough for the results to be of general interest. Detailed results of all tests are kept on file in the Station office and can be had on request.

The year 1923 was a very disappointing one to us in getting comparable results, as well as in general yields. The extreme amount of rainfall, by drowning out plats and ruining stands, made conditions such that we were unable to obtain reliable results from many of our tests. In such cases no yields were recorded. The results published herein are only from such plats as were uniform enough for comparison.

The year 1924 has also been an unusual one, no rain of any consequence having fallen between June 1 and December 4. Under this condition the cotton crop held up fairly well; we had no boll weevil, and consequently made a good crop. Corn, however, suffered greatly, and very little data were obtained from any of the corn or lespedeza tests.

The management has been very much encouraged this year by the interest that has been shown in the Station by the farmers of this section, parties from several counties having visited the Station during the growing season, and all seemed well pleased with the work that is being conducted. A great part of the work here consists in showing visitors over the farm, answering questions, and otherwise carrying results to the farming people.

The tests here pertain only to crops, there being no live stock kept other than work animals. Some of the leading questions pertaining to money, feed, and truck crops have been taken up and are reported under the crop heads.

COTTON

VARIETIES—Tests of the promising varieties have been conducted here for four years. Tables I, II, and III show their comparative performance. In studying these tables it is well to keep in mind that 1923 was a wet year with heavy boll weevil infestation; while 1924 was dry with no boll weevil infestation. In table III only such varieties as have been in the test for four years are given.

Table 1. Cotton Variety Test 1923.

VARIETY	Yield Seed C. Per A.	Yield Lint C. Per A.	Per Cent of Lint	Length of Staple	Price of Lint	Money Value Per A.	Rank Money Value
Miss. Sta. Trice	325.3	99.9	30.7	1 1/16	34	39.61	1
Cleveland, Wannamaker	145.1	53.5	36.9	13-16	32 3/4	19.81	19
Cleveland, Piedmont	225.5	75.1	33.3	15-16	33 1/2	28.92	6
Cleveland 54	210.7	73.5	34.9	15-16	33 1/2	28.04	7
Half & Half	194.6	73.8	37.9	3/4 F	32 1/4	26.82	9
Cook 588	163 3	60.4	37.0	7/8	33 1/4	22.65	16
Willis	253.6	88.0	34.7	15-16F	33 1/2	33.62	2
Miller	195.8	65.0	33.2	1 1/16	34	25.37	11
Acala No. 5	190.1	68.8	36.2	1 1/16	34	26.42	10
Lone Star—65	226.0	75.7	33.5	1 1/8	34 1/2	29.88	5
Salsbury	166.3	54.4	32.7	1 1/8 F	34 1/2	21.57	18
Webber 49-4	184.8	56.5	30.6	1 1/4	36 1/2	23.83	14
Webber Deltatype	212.6	63.6	29.9	1 1/4 F	37	27.25	8
Sunpress	199.0	54.9	27.6	1 1/4 F	37	23.91	13
Delfos 631	228.4	75.1	32.9	1 1/16 F	35 1/4	30.30	4
Delfos 6102	168.2	54.2	32.2	1 1/16	35	21.82	17
Express, Walcott	148.9	44.4	29.8	1 1/16	35	18.51	20
Express 782	115.9	38.1	32.9	1 1/16	35	15.30	22
Express, Lightning	252.6	76.8	30.4	1 1/16	35	31.23	3
Express 630	196.3	60.1	30.6	1 1/16	35	24.44	12
Express, D. & P. L. No. 3	118.6	36.3	30.6	1 1/4	36 1/2	15.31	21
Express 350	196.6	55.6	28.3	1 1/16	35	22.99	15

Note: Willis cotton has heretofore been called Willis Triumph. It is so different from ordinary Triumph that the Experiment Station organization has decided to call it Willis.

Table II. Cotton Variety Test 1924.

VARIETY	Yield Seed C. Per A	Yield Lint C. Per A.	Per Cent of Lint	Length of Staple	Price of Lint	Total Money Value	Rank in Money Value
Lone Star 65	1305	462.1	35.4	1 1/16	25.00	132.39	1
Acala	1232	469.5	38.1	1 1-32	24.75	131.46	2
D. & P. L. No. 4	1194	461.2	38.6	1 1/16F	25.25	131.11	3
Willis	1277	461.1	36.1	15-16F	24.40	128.84	4
Delfos 6102	1258	438.9	34.9	1 1/16F	25.25	127.20	5
Cleveland 54	1227	455.3	37.1	15-16	24.25	125.85	6
Delfos 911	1196	416.3	34.8	1 1/8	26.00	123.84	7
Miller	1227	439.5	35.9	1	24.50	123.43	8
Half & Half	1131	468.2	41.4	13-16	23.50	123.28	9
Salsbury	1229	428.9	34.9	1 1/16	25.00	123.23	10
Cleveland, Piedmont	1163	436.2	37.5	7/8F	24.00	119.23	11
Lightning Express	1145	374.5	32.7	1 3/16	27.00	116.54	12
Cook 1346	1075	425.9	39.6	7/8	23.75	114.14	13
Cleveland, Coker	1063	411.5	38.7	15-16	24.25	112.83	14
Delfos 631	1111	376.8	33.9	1 1/8	26.00	112.67	15
Lone Star 65-A2	1112	385.9	34.7	1 1/16	25.00	111.01	16
Express 782	1056	354.8	33.6	1 1/8F	26.50	108.05	17
D. & P. L. No. 5	1001	345.4	34.5	1 3/16	27.00	106.37	18
Miss Sta. Trice	1090	360.8	33.1	1	24.50	102.98	19
Cleveland, Wannamaker	909	361.7	39.8	7/8	23.75	96.84	20
Burdett Trice	946	320.8	33.9	15-16	24.25	90.30	21
Deltatype Webber	811	232.0	28.6	1 3/16	27.00	74.32	22
Webber 49-6	778	231.0	29.7	1 3/16	27.00	73.30	23

Note: Willis cotton has heretofore been called Willis Triumph. It is so different from the ordinary Triumph that the Experiment Station organization has decided to call it Willis.

Table III. Summary Cotton Variety tests—1921-22-23-24.

VARIETY	Average Lint Per cent	Average Length of Staple	Total Money Value	Rank in Money Value
Miss. Station Trice	31.8	1 3-64	86.29	4
Cleveland, Wannamaker	38.1	51-64	73.61	13
Cleveland 54	36.1	55-64	84.35	7
Cleveland, Piedmont	35.7	13-16	81.46	11
Half & Half	42.2	11-16	84.99	5
Miller	34.3	1 3-64	82.44	8
Lone Star 65	33.9	1 1/8	95.28	2
Acala	33.9	1 3-64	84.65	6
Salsbury	33.8	1 3-64	81.89	10
Delfos—6102	33.0	1 5-32	98.21	1
Delfos—631	33.0	1 3-16	90.45	3
Express—782	32.9	1 3-16	82.12	9
Webber—49	30.1	1 15-64	68.60	14
Deltatype Webber	30.1	1 1/4	75.89	12

CONCLUSIONS—Based on the above information we recommend,

1. For hill land, Miss. Station Trice, Willis Triumph, Cleveland-54, Acala, and Miller.
2. For bottom and rich hill land, Delfos, Lone Star-65, Miss. Station Trice, Acala, and Miller.

FERTILIZERS—Tables IV and V show results from fertilizer work here for two years. It is interesting to note that fertilizers as a whole gave profitable results, even with as low yields as were obtained in 1923.

Table IV. Cotton Fertilizer Test—1923.

FERTILIZER USED Pounds Per Acre	Yield Per A.	Increase Per A.	Cost of Fetiltzer	Value of Increase	Net Profit Per Acre
200 lbs. A.P., 100 lbs. N.S.	191.8	77.4	4.55	9.29	4.74
200 lbs. A.P., 150 lbs. N.S.	227.8	133.4	5.92	16.01	10.09
300 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	183.0	119.3	6.35	14.31	7.96
200 lbs. A.P., 100 lbs. N.S. and 100, lbs. Kainit	124.8	57.3	5.45	6.88	1.43
300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	215.5	144.8	9.10	17.37	8.27
200 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	229.9	114.9	8.20	13.79	5.59
5 tons Stable Manure and 200 lbs. A.P.	338.5	218.6	6.80	26.23	19.43
5 tons Stable Manure and 200 lbs. A.P., 100 lbs. Kainit	288.3	140.0	7.70	16.79	9.09

All plats in this test are not recorded, some having been drowned out. Check plats are not given, all increase yields being figured from a non-fertilized plat adjoining each plat.

Table V. Cotton Fertilizer Test—1924.

Plot No.	FERTILIZER USED Pounds Per Acre	Yield Per Acre	Increase Per Acre	Cost of Ferilizer	Value of Increase	Net Profit Per Acre
1	100 lbs. Nitrate Soda	527.9	73.3	2.86	7.33	4.47
2	No Fertilizer	454.6				
3	200 lbs. Acid Phosphate	542.6	88.3	1.67	8.83	7.16
4	200 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	690.3	292.1	5.33	29.21	23.88
5	No Fertilizer	398.2				
6	200 lbs. A.P., 100 lbs. N.S.	484.2	136.0	4.53	13.60	9.07
7	150 lbs. A.P., 100 lbs. N. S. and 75 lbs. Kainit	528.0	188.4	4.72	18.84	14.12
8	No Fertilizer	344.6				
9	150 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	524.9	180.3	4.92	18.03	13.11
10	250 lbs. A.P., 100 lbs. N.S.	424.0	127.7	4.95	12.77	7.82
11	No Fertilizer	296.3				
12	250 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	499.4	203.1	5.75	20.31	14.56
13	300 lbs. A.P., 150 lbs. N.S.	397.1	138.7	6.80	13.87	7.07
14	No Fertilizer	258.4				
15	300 lbs. A.P., 150 lbs. N.S. and 100 lbs. Kainit	582.0	323.6	7.60	32.36	24.76
16	300 lbs. A.P., 200 lbs. N.S.	520.4	139.3	8.23	13.93	5.70
17	No Fertilizer	331.1				
18	300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	608.8	277.7	9.03	27.77	18.74
19	400 lbs. A.P., 300 lbs. N.S. and 100 lbs. Kainit	683.5	284.1	11.3	28.41	17.11
20	No Fertilizer	399.4				

COOPERATIVE FERTILIZER TESTS—Tables VI, VII, VIII, and IX give results of tests made in cooperation with the farmers named. All measuring of land and weighing of fertilizer and yields were done by the writer.

Table VI. Cooperative Cotton Fertilizer Test with Mr. J. B. Brabston, Bovina, Miss.—1924.

FERTILIZER USED Pounds Per Acre	Yield Per Acre	Increase Per Acre	Cost of Fertilizer	Value of Increase	Net Profit Per Acre
100 lbs. Nitrate Soda	451.7	185.4	$18.54	$ 2.86	$15.68
200 lbs. Acid Phosphate	274.6	8.3	.83	1.67	.84 loss
No Fertilizer	266.3				
200 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	454.0	187.7	18.77	5.33	13.44
200 lbs. A.P., 100 lbs. N.S.	465.6	182.9	18.29	4.53	13.76
No Fertilizer	282.7				
150 lbs. A.P., 100 lbs. N.S. and 75 lbs. Kainit	491.9	209.2	20.92	4.72	16.20
160 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	501.9	176.7	17.67	4.92	12.75
No Fertilizer	325.2				
250 lbs. A.P., 100 lbs. N.S.	536.0	211.8	21.18	4.95	16.23
250 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	550.4	196.2	19.62	5.75	13.87
No Fertilizer	354.2				
300 lbs. A.P., 150 lbs. N.S.	559.1	194.9	19.49	6.80	12.69
300 lbs. A.P., 150 lbs. N.S. and 100 bls. Kainit	557.3	247.4	24.74	7.60	17.14
No Fertilizer	309.9				
300 lbs. A.P., 200 lbs. N.S.	631.9	322.0	32.20	8.23	21.97
300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	652.1	342.2	34.22	9.03	25.19

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...tion sheet for Bulletin 224. "Report Raymon... Branch Station".
...llowing tables should be as follows:

...VI, Cooperative Cotton Fertilizer Test with Mr. J. B. Brabston,
... Miss., -1924.

...izer Used Per Acre	Yield Per Acre	Increase Per Acre	Value of Increase	Cost of Fertilizer	Net Profit Per Acre
...trate Soda	451 7	185.4	$[illegible]	$2 86	$15.68
...d Phosphate	274 6	8.3	[illegible]	1.67	.84 loss
...ilize	266 3				
...sphate, 100#	454.0	187.7	18.77	5.33	13.44
...00# Kainit	465 6	182 9	18.29	4.53	13.76
...100# N. S.	282.7				
...zer					
...00# N. S. &	401 9	209.2	20 92	4 72	16.20
...00# N.S. &	501.9	176 7	17.67	4.92	12.75
	325.2				
...0# S	536.0	211.8	21 18	4.95	16.23
...00# .S. &	550.4	196 2	19.62	5 75	13.87
...lizer	354.2				
150# N.S.	559.1	194 9	19.49	6.80	12.69
150# N.S. &	557.3	247.4	[illegible]	7.60	17.14
...per	309.9				
...00# N S.	631.9	322.0	[illegible]	8.23	21.97
300# A.P., 200# N.S. & ...# Kainit	652.1	342.2	34.22	9.03	25.19

Tomato Variety Test, - 1924.

Bulk Yield Lb. Per Acre	Per cent shipping Tomatoes	Yield Shipping Tomatoes Lb. Per A...	Per cent of Bulk Picked Fi...	Per cent of Shippers Picked Early	Average Size of Shippers
14,937	39.0	5,818	37.7	43.9	.295
15,867	28.3	4,513	29.6	47.9	.337
20 214	27.7	5,636	32.6	55.8	337
12,078	30.3	3,682	32.5	44.8	.332
12,507	26.6	3,339	32.1	46.2	.320

Table VII. Cooperative Cotton Fertilizer Test with Mr. J. B. Brabston, Bovina, Miss.—1923.

FERTILIZER USED Pounds per Acre	Yield Per Acre	Increase Per Acre	Cost of Fertilizer	Value of Increase	Net Profit Per Acre
100 lbs. Nitrate Soda	131.2	64.5	$ 7.74	$2.75	$4.99
200 lbs. Acid Phosphate	76.5	9.7	1.16	1.80	.64 loss
No Fertilizer	66.3				
200 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	171.9	105.1	12.61	5.45	7.16
200 lbs. A.P., 100 lbs. N.S.	151.3	74.3	8.92	4.55	4.37
No Fertilizer	77.1				
150 lbs. A.P., 100 lbs. N.S. and 75 lbs. Kainit	176.5	99.5	11.94	4.78	7.16
150 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	162.1	65.3	7.84	5.00	2.84
No Fertilizer	96.9				
250 lbs. A.P., 100 lbs. N.S.	162.4	65.6	7.87	5.00	2.87
250 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	170.2	64.8	7.78	5.90	1.88
No Fertilizer	105.4				
300 lbs. A.P., 150 lbs. N.S.	196.2	90.7	10.88	6.83	4.05
300 lbs. A.P., 150 lbs. N.S. and 100 lbs. Kainit	192.3	118.2	14.18	7.78	6.45
No Fertilizer	74.2				
300 lbs. A.P., 200 lbs. N.S.	225.4	151.4	18.17	8.20	9.97
300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	251.4	177.3	21.28	9.10	12.18

Table VIII. Coop. Cotton Fertilizer Test, with Dr. J. A. Beavers, Canton, Miss.—1923.

FERTILIZER USED Pounds Per Acre	Yield Per Acre	Increase per Acre	Cost of Fertilizer	Value of Increase	NetProfit Per Acre
100 lbs. Nitrate Soda	869.1	110.9	$13.30	$2.75	$10.55
200 lbs. A.P.	920.2	157.1	18.85	1.80	17.05
No Fertilizer	763.0				
200 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	1023.4	310.2	37.23	5.45	31.78
200 lbs. A.P., 100 lbs. N.S.	1073.4	165.7	19.89	4.55	15.34
No Fertilizer	762.1				
150 lbs. A.P., 100 lbs. N.S. and 75 lbs. Kainit	1014.4	252.3	30.28	4.78	25.50
150 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	1015.0	262.2	31.45	5.00	26.46
No Fertilizer	752.4				
250 lbs. A. P., 100 lbs. N.S.	869.5	116.7	14.00	5.00	9.00
250 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	811.9	100.7	12.08	5.90	6.18
No Fertilizer	711.4				
300 lbs. A.P., 150 lbs. N.S.	841.2	148.2	17.78	6.83	10.95
300 lbs. A.P., 150 lbs. N.S. and 100 lbs. Kainit	804.3	174.3	20.92	7.73	13.19
No Fertilizer	630.0				
300 lbs. A.P., 200 lbs. N.S.	794.1	164.1	19.69	8.20	11.49
300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	945.6	242.1	29.05	9.10	19.95

Table IX. Cooperative Fertilizer Test with Mr. J. R. Anderson, Flora, Miss.—1923.

FERTILIZER USED Pounds Per Acre	Yield Par Acre	Increase per Acre	Cost of Fertilizer	Value of Increase	Net Profit Per Acre
100 lbs. Nitrate Soda	731.2	119.6	$14.36	$2.75	$11.61
200 lbs Acid Phosphate	585.4	25.2	3.02	1.80	1.22
200 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	742.0	129.4	15.53	5.45	10.08
200 lbs. A.P., 100 lbs. N.S.	647.2	114.3	13.72	4.55	9.17
150 lbs. A.P., 100 lbs. N.S. and 75 lbs. Kainit	701.0	168.1	20.17	4.78	15.39
150 lbs. A.P., 100 lbs. N.S. and 100 lbs. Kainit	723.4	185.5	22.26	5.00	17.26
250 lbs. A.P., 100 lbs. N.S.	685.2	150.6	17.07	5.00	12.07
300 lbs. A.P., 150 lbs. N.S.	688.6	154.0	18.48	6.83	11.65
300 lbs. A.P., 160 lbs. N.S. and 100 lbs. Kainit	752.4	221.2	26.54	7.73	18.81
300 lbs. A.P., 200 lbs. N.S.	838.0	306.8	36.82	8.20	28.62
300 lbs. A.P., 200 lbs. N.S. and 100 lbs. Kainit	837.6	306.4	36.77	9.10	25.67

CONCLUSIONS—The above tests indicate conclusively that soils in this section react profitably to high quantities of fertilizers. Acid phosphate should not be used alone, nitrate of Soda does fairly well alone. A mixture of 300 pounds acid phosphate, 200 pounds nitrate soda, and 100 pounds kainit has made an outstanding profit in all tests. We advise this mixture or as near to it as possible for this section. Potash proves itself valuable and should be used in all mixtures.

SPACING—The value of close spacing has been previously proven. However, the following results are interesting:

Table X. Spacing Test—1924.

	Stalks per A.	Yield per A.	Increase in Yield	Value of Increase
Average of 7 Thin plats	10,000	641.0 lbs.		
7 thick plats	20,280	775.5 lbs.	134.5	$13.45

This cotton was thinned entirely by negro labor. All plats were thinned too much.

CORN

VARIETIES—The results of variety tests of 1923 and 1924 follow in tables XI and XII.

Table XI. Corn Variety Test—1923.

VARIETY	Yield Bu Ear Corn Per Acre	Per cent of Grain	Yield Bu Good Grain per acre	Yield Bu. damaged Grain Per Acre	Total Money Value per acre	Rank in Money Values
Williamson	24.00	78.28	20.31	2.25	21.64	6
Biggs Seven Bay	19.70	82.44	17.48	2.81	18.89	12
Whatley	25.36	81.56	22.65	2.32	23.81	1
Mosby, Station	22.41	82.72	20.93	1.48	21.67	5
Mosby, Delta	24.45	82.04	22.81	1.41	23.51	2
Cocke's Prolific, Sta.	24.90	80.76	22.14	2.15	23.21	3
Cocke's Prolific, Delta	22.30	84.48	20.27	2.41	21.47	7
Davis Prolific	19.02	82.96	17.04	2.01	18.04	15
Hastings	23.66	82.56	21.67	2.0	22.67	4
Vardaman	21.73	84.72	20.78	1.34	21.45	8
Marlboro	22.53	77.76	18.71	2.10	19.76	11
Laguna	20.72	83.96	15.15	2.05	16.17	18
Mexican June	21.17	82.96	19.77	1.37	20.45	10
Rockdale	19.70	84.96	16.40	3.90	18.35	13
Paymaster, Neals	19.70	82.84	12.57	7.22	16.18	17
Paymaster, Harpeth	19.36	83.44	13.86	5.65	16.69	16
Ellis	22.53	81.36	19.67	2.45	20.90	9
Delta Prolific	19.47	82.96	16.81	2.72	18.17	14
Yellow Dent, Ferguson	16.07	81.16	10.45	5.29	13.14	20
Yellow Dent, Stewart	15.06	80.40	11.99	2.44	13.21	19

Table XII. Corn Variety Test—1924.

VARIETY	Yield Bu. ear corn per acre	Per cent of grain to ear	Yield Bu. good grain per acre	Yield Bu damaged grain per acre	Total Money Value per acre	Rank in Money Value
Williamson	19.74	80.2	13.69	2.84	23.38	16
Biggs' Seven Bay	15.97	77.2	7.92	5.89	17.77	18
Whatley	23.21	83.8	15.89	4.54	28.38	6
Mosby, Station	21.75	79.6	12.41	6.17	24.79	14
Mosby, Delta	22.45	82.2	16.16	4.18	28.42	5
Mosby, Lee's	22.60	77.3	13.61	5.43	25.85	11
Mosby, Harpeth's	21.55	80.3	14.41	3.65	25.27	13
Cocke's Prolific, Station	25.02	77.5	16.72	6.43	31.51	3
Cocke's Prolific, Delta	21.49	81.3	15.69	4.09	27.63	10
Hastings	21.19	84.0	17.44	1.96	28.12	7
Laguna	28.63	78.8	24.01	2.32	38.34	1
Mexican June	28.78	80.3	23.37	1.47	36.53	2
Tennessee Red Cob	21.10	79.0	14.25	4.35	25.73	12
Paymaster	23.66	82.3	13.15	8.35	28.08	9
Ellis	22.00	80.5	17.07	2.51	28.12	8
Delta Prolific	21.40	82.7	17.92	1.71	28.59	4
Yellow Dent	18.23	74.9	8.73	6.91	20.01	17
Large Golden Dent	21.22	77.8	12.32	5.44	23.92	15

CONCLUSION—We recommend for general use, Whatley, Mosby, Cocke's Prolific, Hastings, and Ellis.

FERTILIZERS—In both 1923 and 1924 weather conditions ruined our corn fertilizer tests. For general conditions we recommend 200 pounds acid phosphate and 100 pounds nitrate soda.

ENGLISH PEAS

FERTILIZERS—Table XIII gives results of a test to determine the best formula to use. Table XIV deals with the sources of nitrogen.

Table XIII. English or Green Pea Fertilizer Test.—1924.

Amount of Application per Acre	10 3.3 Formuta Yield	8-3-3 Formula Yield	8-4-3 Formula Yield	Average Yield Per Acre
	lbs.	lbs.	lbs.	lbs.
1500 pounds	2070	2120	2625	2272
1000 pounds	2308	2500	2865	2824
Average yield per A.	2189	2310	27.45	

Table XIV. English or Green Pea Fertilizer Test.—1924.

Amoumt of Application per Acre	Yield using nitrate soda for nitrogen	Yield using Ammonium Sulphate for nitrogen	Average Yield
	lbs.	lbs.	lbs.
1000 pounds per A.	3269	2820	3045
1500 pounds per A.	3189	2581	2885
Average yield per A.	3229	2701	

CONCLUSIONS—The above tables indicate that an 8-4-3 formula, using nitrate of soda as the source of nitrogen and applied at the rate of 1000 pounds per A. is most effective.

SNAP OR GREEN BEANS

FERTILIZERS—Tables XV and XVI deal with formulas, sources of nitrogen and rate of application.

Table XV. Snap or Green Bean Fertilizer Test.—1924.

Amount of Application per Acre	Yield pes Acre			
	using 10-3-3 Formula	using 8-3-3 Formula	using 8-4-3 Formula	Average
	lbs.	lbs.	lbs.	lbs.
1500 pounds per A.	2400	1489	2188	2026
1000 pounds per A.	3357	3128	2767	3084
Average yield per A.	2879	2309	2478	

Table XVI. Snap or Green Bean Fertilizer Test.—1924.

Amount of Application per Acre	Yield per Acre		
	Using nitrate soda source of nitrogen	Using Amn. Sulphate as source of nitrogen	Average
	lbs.	lbs.	lbs.
1000 pounds per A.	3972	3829	3902
1500 pounds per A.	5079	5007	5043
Average yield per A.	4526	4418	

CONCLUSIONS—The above results indicate that 1500 pounds per acre of a 10-4-3 mixture with either nitrate soda, ammonium sulphate, or a combination of the two used as the source of nitrogen.

TOMATOES

VARIETIES—See table XVII.

Table XVII. Tomato Variety Test.—1924.

VARIETY	Bulk Yield Lbs. per A.	Per cent shipping tomatoes	Per cent Shipping Tomatees Lbs.per A	Per cent of bulk picked early	Per cent of shippen picked early	Average size of shippers
Marvel	14,937	39.0	5,818	37.7	49.9	.295
Earli Belle	15,867	28.3	4,513	29.6	47.9	.337
Gulf States Market	20,214	27.7	5,636	32.6	55.8	.337
Detroit	12,078	30.3	3,682	32.5	44.8	.332
Globe	12,507	26.6	3,339	32.1	46.2	.320

CONCLUSION—Of the varities in the test the Gulf States Market stands high in bulk yield, yield of shippers, earliness, and size of fruit. The Marvel stood very high in yield of shippers, percent of shippers, and earliness. It was somewhat low in size of fruit. Gulf States Market or Earli Belle is recommended for soils not infected with wilt and Marvel for wilt infected soils.

FERTILIZERS—Several phases of this subject are covered as follows: Table XVIII deals with the use of potash; table XIX with formulas; table XX with sources of nitrogen. In all these tables comparisons of varying amounts per A. are included. In table XX a standard 8-4-3 mixture was used in all plats. Combination, means equal parts of nitrogen derived from the four sources in the test.

Table XVIII. Potash test with Tomatoes.—1924.

Formula and rate of application per acre	Bulk Yield Lbs. per Acre	Per cent shipping tomatoes	Yield of shippers	Per cent of bulk picked early	Per cent shippers ptcked early	Average size of shippers
8—4—0 at 1000 lbs.	15,163	38.6	5,811	33.3	51.6	.294
8—4—3 at 1000 lbs.	15,989	38.4	6,087	36.9	54.6	.310
8—4—6 at 1000 lbs.	18,070	43.8	7,609	37.2	51.2	.313
8—4—0 at 1500 lbs.	17,465	40.4	7,018	38.6	52.4	.276
8—4—3 at 1500 lbs.	16,158	42.5	6,928	32.2	40.3	.324
8—4—6 at 1500 lbs.	16,540	41.3	6,888	30.4	41.8	.311
8—4—0 at 2000 lbs.	17,198	42.6	7,330	32.4	42.2	.312
8—4—3 at 2000 lbs.	18,992	43.0	8,158	33.0	47.2	.317
8—4—6 at 2000 lbs.	17,900	45.2	8,077	29.6	39.4	.320
Summary of all formulas and rates of application.						
8—4—0	16,609	40.5	6,720	34.8	48.8	.294
8—4—3	17,046	41.3	7,058	34.0	47.4	.317
8—4—6	17,503	43.4	7,528	32.4	44.1	.315
1000 lbs. per A.	16,407	40.3	6,502	35.8	52.5	.306
1500 lbs. per A.	16,721	41.4	6,945	33.7	44.8	.304
2000 lbs. per A.	18,027	43.6	7,855	31.7	42.9	.316

Table XIX. Fertilizer test with Tomatoes using different Formulas. 1924

Formula and rate of application per acre	Bulk Yield Lbs. per A	Per cent shipping tomatoes	Yield of shippers	Per cent of bulk picked early	Per cent of shipper picked early	Average size of shippere
10—3—3 at 1500 lbs.	13449	43.7	5883	34.0	42.5	.377
8—3—3 at 1500 lbs.	12474	43.8	5461	30.8	43.4	.378
8—4—3 at 1500 lbs.	9509	33.7	3205	25.5	33.0	.337
8—5—3 at 1500 lbs.	9513	43.2	4121	33.4	42.7	.383
10—3—3 at 2000 lbs.	16776	43.5	7297	33.6	40.5	.372
8—3—3 at 2000 lbs.	13477	43.3	5837	38.5	49.4	.398
8—4—3 at 2000 lbs.	12196	35.6	4348	30.8	40.2	.361
8—5—3 at 2000 lbs.	11716	37.4	4382	33.4	37.1	.324
Summary of formulas and rates of application.						
10—3—3	15113	43.6	6590	33.8	41.5	.376
8—3—3	12976	43.6	5649	34.7	46.4	.388
8—4—3	10853	34.7	3777	28.2	36.6	.349
8—5—3	10615	40.3	4257	33.4	39.9	.354
1500 lbs. per A.	11236	41.1	4668	30.9	40.4	.369
2000 lbs. per A.	13541	40.0	5466	34.1	41.8	.364

Table XX. Sources of Nitrogen in Fertilizers for Tomatoes—1924.

Source of Nitrogen and rate of application per acre	Bulk Yield Lbs. Per Acre	Per cent shipping tomatoes	Yield of shippers	Per cent of bulk picked early	Per cent of shippers picked early	Average size of shippers
Nitrate Soda						
1500 lbs. per A.	10880	36.3	3941	33.6	52.5	.319
Ammonium Sulphate						
1500 lbs. per A.	8536	35.7	3050	37.6	54.5	.292
Combination						
1500 lbs. per A.	8606	34.7	2992	35.8	53.0	.282
Tankage						
1500 lbs. per A.	7712	35.9	2765	27.2	36.0	.265
Cottonseed Meal						
1500 lbs. per A.	9383	34.0	3172	33.1	45.2	.282
Nitrate Soda						
2000 lbs. per A.	12769	39.9	5071	36.7	50.9	.280
Ammonium Sulphate						
2000 lbs. per A.	12436	40.5	5006	33.3	46.1	.267
Combination						
2000 lbs per A.	14777	36.7	5428	31.3	44.3	.267
Tankage						
2000 lbs. per A.	13190	36.8	4836	33.3	47.1	.277
Cottonseed Meal						
2000 lbs. per A.	14245	37.0	5280	33.5	48.0	.277
Summary						
Nitrate Soda	11825	38.1	4506	35.2	51.7	.300
Ammonium Sulphate	10467	38.1	4026	35.5	50.3	.280
Combination	11692	35.7	4210	33.6	48.9	.274
Tankage	10451	36.4	3801	30.3	41.6	.271
Cottonseed Meal	11814	35.5	4226	33.3	46.6	.280
1500 lbs. per A.	9023	35.3	3184	33.5	48.2	.288
2000 lbs. per A.	13483	38.2	5124	33.6	47.3	.274

CONCLUSIONS—We have a clear indication of potash increasing the yield, however there seems to be a limit above which the yield decreases. There is a slight increase in the percent of marketable tomatoes, and in the size of fruit with the higher quantities of potash. Potash in high quantities made slightly later maturity. Some data were obtained relative to keeping qualities, but it was not conclusive enough to warrant definite recommendations. At least 3 percent of potash is considered necessary in a fertilizer formula.

In table XIX a 10-3-3 mixture gave highest yields. A variation of mixture affected earliness and percent of shippers very little.

In table XX nitrate of soda leads in yield as a source of nitrogen, closely followed by cottonseed meal, and a combination of sources. Nitrate of soda and ammonium sulphate led in percentage of shipping tomatoes, earliness, and size of fruit.

In all the tables 2000 pounds per acre gave the most profitable

yield, and the higher percent of shippers. A variation of quantity seemed to vary in its effect on earliness and size of fruit.

Based on these tests, we recommend the use of 2000 pounds per acre of a 10-4-3 mixture, the nitrogen derived, equal parts from nitrate soda, ammonium sulphate and cottonseed meal.

GENERAL WORK

Experiments with Vetch, Burr clover, Lespedeza, Crimson clover, Soy beans and peas in rotation have not progressed sufficiently for conclusive data other than to say that: Vetch and Burr clover thrive well and reseed themselves in this section and are considered excellent soil builders and grazing crops. Soy beans grow well and are considered our best hay crop. Crimson clover thrives and is an excellent soil builder. Lespedeza is a standard hay and pasture crop here, and will yield more with less attention than any other crop.

No data are available, but outstanding results have been obtained in saving soil and crops by a small expenditure in terracing and ditching.

Bulletin 225 December, 1924

REPORT

South Mississippi Branch Experiment Station

1922, 1923, and 1924

By

E. B. FERRIS

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. Ricks, Director

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J. R. Ricks, M. Sc. — Director and Chief in Agronomy
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K. C. Livingston — Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. — Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. — Collaborator
E. C. Ewing, M. Sc. — Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

A REPORT OF WORK AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION FOR 1923 AND 1924.

By E. B. Ferris Assistant Director in Charge

INTRODUCTION—This work includes the work for two years, because at the end of 1923 we were unable to publish an Annual Report on account of insufficient funds. However, we were able to give our results to the public by using the daily and weekly papers, as well as furishing mimeograph copies to the various county agents.

WEATHER CONDITIONS—During the period covered by this report, the weather conditions have been most unusual. This has had more to do with the results than any other single factor. We feel that a report of a two year's work will give a much more accurate idea as to what might be expected under average weather conditions, than would a report for either years' work alone. The year 1923 was perhaps the wettest year from the standpoint of frequent showers during the growing season of cotton, while we feel sure that 1924 has been the driest and hottest for a similar period, that

TABLE NO. 1—COMPARATIVE WEATHER RECORDS FOR 1923-1924 MARCH TO OCTOBER INCLUSIVE

Month	Year	Maximum	Minimum	No. Days 100° & Over	No. Rainy Days	Total Rainfall	Mean Max. Tem.	Mean Min. Tem.	Av. Rainfall 21 yrs.
March	1923	85	27	0	12	5.17	70.9	48	5.3
March	1924	87	31	0	5	2.38	68.2	45.5	
April	1923	89	35	0	12	3.26	79.4	55.3	5.7
April	1924		36	0	6	2.38		57.6	
May	1923		95	0	13	2.89	84.4	60.0	5.6
May	1924				8	2.98			
June	1923	96	56	0	16	7.29	69.7	65.9	5.9
June	1924	100	66	2	12	6.23	94.2	71.7	
July	1923	97	60	0	18	6.39	90.2	70.1	6.2
July	1924	103	59	6	4	.87	95.6	71.5	
August	1923	97	67	0	18	6.48	92.2	71.5	5.8
August	1924	103	67	12	5	1.43	98.1	72.5	
Sept.	1923	97	60	0	9	2.28	92.7		5.1
Sept.	1924	100	48	1	4	.87	90.0	66.6	
Oct.	1923	97	36	0	5	4.28	80.8	57.0	2.9
Oct.	1924	92	44	0	1	.32			
Nov.	1923	74	34	0	7	6.55	64.4	45.8	3.2
Nov.	1924	94	30	0	1	.05			

this section has ever known. This has certainly been the case during the period our Station has been located in this territory, which is twenty-three years.

The table above giving a maximum and minimum temperatures, total rainfalls, number of days on which the thermometer went over 100 degrees, and the number of days on which .01 inches or more of rain-fall will give a comparative idea of the weather conditions during the cropping seasons for the two years.

A number of minor improvements have been made at this Station since the last report. Our grounds have been laid out so as to facilitate the easy inspections of plat work by visitors, also the fences around the buildings have been repaired and the lawns beautified. In addition to these improvements, a small bungalow was built at a cost of $2000, for the Station Horticulturist.

During the two years we have conducted cooperative fertilizer tests in three different parts of the section, namely Columbia, Moselle and Laurel. We feel that the results obtained on the farm of Mr. Albert Singley, near Columbia are dependable, but due to the adverse weather conditions, the results at the other two places were unsatisfactory. We also plan several cooperative cotton variety tests in these three localities and all of these results are given in this report.

In 1923 The State Plant Board stationed one of its representatives with us. We feel that this has been worth much to the Station, and to this section because it is a section which is being developed to fruits and vegetables and these have many insect pests, and plant diseases not familiar to the average farmer. In a separate portion of this Bulletin will be found a report by Mr. R. C. Price, Representative of the Plant Board, also a separate report of W. S. Anderson, who succeeded Mr. F. B. Richardson as Horticulturist for the Station.

We feel that the work of this Station has been greatly improved by a careful planting of all experiments in advance at Annual meetings of Experiment Station workers held at the A. & M. College. As a result of these plans, some of the work has been cut out here because it could be better done at other Stations, and we are able to concentrate along lines that would better apply to South Mississippi conditions. All the Stations in the Sate have been cooperating in the matter of testing the best known varieties of cotton and corn and the Plant Breeder at the main Station at the A. & M. College has assisted us in developing a strain of cotton better suited to our conditions. During this period we have endeavored to carry the results of the Experiment Station to the people through personal visits, attending farmers' meetings, preparing weekly articles for four or five papers circulating in South Mississippi, and we are sending out numerous small circulars.

COTTON EXPERIMENTS.

The work at this station for the past two years has given us an excellent opportunity to study the various varieties, as well as the results from various fertilizer combinations, under extreme weather conditions. In 1923 the earlier varieties, like Miss. Sta. Trice, gave decidedly larger yields, while in 1924 these varieties had no such advantage because dry weather

controlled the weevil. From our results we believe that under average conditions, and especially where farmers do not expect to control the boll weevil, the early fruiting varieties should be grown.

In addition to the variety and fertilizer tests on the station farm, we ran some cooperative variety and fertilizer tests with farmers located at Columbia, Moselle, and Laurel. Various other tests, such as spacing, cultural methods etc. were carried on at the station. The results of these tests are published in detail in Circular No. 56 "Cotton Experiments, South Mississippi Branch Experiment Station," which may be had on application to the Director of Experiment Stations, A. & M. College, Mississippi.

CORN EXPERIMENTS.

We have reported no work with corn since 1921. This report should be for three years; however, in 1922 our variety yields were so badly attacked by the Southern Green Plant Bug that the results were no good. In 1923 and 1924, these tests were good and the following table gives these results:

TABLE NO. II—CORN VARIETY TEST, 1923 AND 1924

VARIETY	1923			1924		
	Total bu. per Acre	Percent Grain to Ear	Rank	Total bu. per Acre	Percent Grain to Ear	Rank
Williamson	68.7	85	7	38.1	86	16
Biggs Seven Ear	70.9	85	5	33.6	78	18
Whatley	70.7	86	6	40.6	81	9
Mosby, Station	71.9	88	4	41.1	83	7
Mosby, Delta	73.5	86	2	43.3	85	4
Cocke's Prolific, Sta.	73.5	86	1	42.2	82	5
Cocke's Prolific, Delta	65.5	86	12	40.2	82	10
Davis' Prolific	66.4	87	11	---	--	--
Hasting's Prolific	72.3	86	3	39.5	83	12
Vardaman	67.5	86	9	---	--	--
Marlboro	61.6	83	17	---	--	--
Laguna	62.7	84	16	46.4	83	2
Mexican June	56.6	85	21	41.6	80	6
Rockdale	59.1	88	18	---	--	--
Paymaster, Neal	65.4	86	13	49.3	86	1
Paymaster, Harpeth	66.9	84	10	---	--	--
Ellis	63.8	84	15	38.3	80	15
Delta Prolific	68.4	88	8	45.7	85	3
Yellow Dent. Ferguson	57.0	86	20	38.8	80	13
Yellow Dent, Stewart	57.9	84	19	---	--	--
Johnson's Prolific	65.2	87	14	---	--	--
Large Golden Dent	---	--	--	38.5	77	14
Lee Mosby	---	--	--	39.6	86	11
Harpeth Mosby	---	--	--	37.1	85	17
Tennessee Red Cob	---	--	--	40.8	82	8

In Bulletins 194 and 201, we reported results of work here with fertilizers under corn. The same plats used in 1920-21 have been used ever since, except that in 1924 we substituted Ammonium Sulphate for cotton seed meal, using 105 pounds of Ammonium Sulphate where 280 pounds of cotton seed meal had been used. As stated previously, corn is a poor crop from which to draw positive conclusions about fertilizers. It blooms only one time and

final results depend on the character of weather prevailing during the time of pollination. If any conclusion can be drawn from these results, it is that nitrogenous fertilizers in the main, should be used under corn. Our results

TABLE NO. III—FERTILIZER TEST WITH CORN, 1921-1924

Fertilizer Pounds Per Acre	Yields of Corn in Pounds per Acre					
	1921	1922	1923	1924	Average Four Years	Average Increase Over Check lbs.
280 Acid Phos. 280 Cottonseed M. 140 Kainit	1890	1563	1983	1423	1715	295
280 Acid Phos. 140 Nitrate Soda 140 Kainit	2216	1937	2450	1587	2048	628
Check	1610	1107	1866	1097	1420	000
280 Basic Slag 280 Cottonseed M. 140 Kainit	2310	1820	2333	2007	2118	798
280 Acid Phos. 140 Calcium Cyn. 140 Kainit	1983	1820	2776	1703	2070	650
280 Acid Phos. 280 Cottonseed M.	1750	1657	2403	1933	1938	518
280 Acid Phos. 140 Calcium Cyn.	1226	1120	1866	1237	1362	80
140 Ammonium Sul.	1447	1050	1773	1353	1406	124
280 Acid Phos. 140 Nitrate Soda	2077	1937	2310	1654	1995	713
Check	1447	887	1583	1213	1282	00
280 Acid Phos. 140 Ammonium Sul.	1610	1820	2170	1867	1867	585
280 Fla. Soft Phos. 280 Cottonseed M.	1890	1633	1986	1680	1797	515
280 Fla. Soft Phos. 280 Cottonseed M. 140 Kainit	1237	1097	1330	1307	1243	289
Check	1143	840	1203	630	954	
280 Acid Phos. 140 Ammonium Sul. 140 Kainit	1913	1867	2520	2088	2097	1143
140 Calcium Cyn.	1493	1237	2916	1493	1785	831
140 Dried Blood	1750	1633	2450	1517	1838	884
280 Cottonseed M.	1610	1633	2170	1377	1698	744
280 Acid Phos.	770	700	1003	940	741	81
280 Raw Phos. Rock	957	910	1283	443	898	76
Check	863	700	1190	537	822	
280 Basic Slag	933	723	1283	583	880	78
280 Fla. Soft Phos.	933	910	1213	653	928	106
140 Nitrate Soda	1937	1587	2100	1587	1803	981

105 pounds of Ammonium Sulphate used in place of 280 pounds C. S. M. in all mixtures in 1924.

for several years have shown a most economical increase from nitrogenous fertilizers alone.

DAIRY CATTLE.

In 1919 we moved from the old station at McNeil to this place a few head of registered Jersey cattle. Heifer calves from the original cows were kept until now we have a herd of thirty females of choice breeding. These animals are tick immune and as a consequence we are in constant dread of out-break of tick fever, since the ranges surrounding us are infected.

This small dairy herd is beneficial to the Station in that we are able to obtain manure to be used in experimental work as well as other work on the Experiment farm, and at the same time we will soon be in a position to get some experimental data firsthand, which is badly needed for the dairies in South Mississippi. In addition to this we have many visitors, a great many of whom are interested in dairying.

We have a 100 ton silo which we have filled every year except the year 1924. On account of the extreme dry season the sorghum crop which was planted for silage was a complete failure, because of its not coming to stand, due to lack of moisture.

"ROTATION EXPERIMENTS"

Early in 1922 a seven acre field here was laid off into 84 1-20 acre plats. These plats being later divided into four series of 21 plats each. As laid out this gave us 21 plats from east to west, each plat being 14 feet wide by 156 feet long and being separated by a space of 3 1-2 feet. As laid out from north to south there are four series of plats abutting each other, so that the rows may be worked continuously through. Ten feet roadways are left between each series as driveways. Two of these series had received an application of lime at the rate of two tons per acre the year before, two series remained unlimed. Each year since that time one series each on limed and unlimed land have been fertilized with acid phosphate and nitrate soda, and one series each with acid phosphate and sulphate of ammonia furnishing the same amounts of nitrogen and phosphorous. In this work we are using the 21 plats of each series so as to test out 12 different cropping systems, a single plat being used under some systems and as many as three plats under other systems. For instance, plat one in each series grows each year corn and cow peas; plat two grows corn alone; plat four cotton alone; plats 14, 15 and 16 from one rotation and alternate with cotton, corn and oats without legumes; while plats 17, 18 and 19 grow cotton, corn and peas, oats and peas in rotation. This work has been carefully carried out during 1922, 1923 and 1924 and we have the yields obtained from them. It will hardly be worth while to publish such yields at this time as the work has not been going on long enough to show any very decided differences between the several cropping systems. We do notice this, that the cotton grown on eight plats in each series is showing a decided need for potash and in the future we expect to add to the mixture above given, kainit at the rate of 200 lbs. per acre. Up to this time crops other than cotton grown on these plats have shown no very decided need for potash, but most of the cotton in 1924 completely shed its leaves early in August, while the same variety of cotton grown on

nearby fields which had received potash remained green throughout the growing season.

PASTURE WORK

Two years ago this station leased for ten years a forty acre tract of land lying west of our main experimental field and separated therefrom by a farm one-eighth of a mile wide. A good deal of the leased land had never been cleared and has come up as usual to oak sprouts. These have been gradually pulled up during wet weather by a tractor, saved and sold as wood, and the land in 1924 was all available for improved pasture. Also, in the fall of 1924 we burned out a large part of the stumps on this forty acres. In 1923 ten acres of this land was planted to carpet grass and ten acres to lespdeza, and in 1924 practically all of the remainder was prepared and planted to lespedeza. Early in 1924 the ten acres previously planted to carpet grass was laid off into acre blocks and fertilized in seven different ways with three checks unfertilized, using phosphorus, nitrogen, and potash, either alone or in combination. The land was all practically level. The remaining thirty acres was also laid off into acre blocks and practically the same work with fertilizers outlined with the carpet grass was repeated with lespedeza.

Nothing definite so far has resulted from this work for we had much less than our usual rainfall up to and including June, and since June up to the middle of December we have had only a little more than four inches of rain, whereas our normal rainfall should have been above twenty-five inches. As a consequence the land on which we planted lespedeza and which came up to a perfect stand is now almost as bare as a cultivated field. The ten acres devoted to carpet grass on which there was a fair stand is giving no grazing and we will feel fortunate if even this grass survives the drouth.

In addition to the lespedeza planted on the above mentioned pastures we had practically ten acres planted on land leased from the county. The most of this land had been in lespedeza in 1923, when from a choice acre we cut three tons of field-cured hay. The stands of lespedeza in 1924 were equally as good as in 1923, but the extreme drouth has practically killed it out entirely.

COOPERATION WORK WITH THE STATE PLANT BOARD.

By R. C. PRICE

In view of the increasing problems in insect pest and plant disease control, the State Plant Board and Experiment Station coordinated forces to the extent necessary to carry out certain projects along these lines. Experiments in boll weevil control, the growing of an acreage of tomatoes of Wilt resistant varieties for seed increase, and the growing of the sweet potato plants necessary in the sweet potato weevil eradication work were emphasized by this Station; the first two projects named were begun here in 1923 and the last in 1924.

Boll Weevil Experiments: In 1923 a comparative test in which two well known direct control measures, namely, the Coad and the Florida, were used gave very good results. Three one acre plats of Trice cotton were devoted to this experiment. Two of the plats were poisoned, one by the Coad method

and the other by the Florida method; the third plat was left unpoisoned as a check. The Coad method and the Florida method plats yielded nine hundred sixty-five pounds and one thousand ten pounds seed cotton respectively, or an increase over check of one hundred firty-one pounds and one hundred eighty-six pounds seed cotton; the check plat yielded eight hundred twenty-four pounds seed cotton. The cost of poisoning the one acre by the Coad method was $5.20; for the Florida method, $5.30. Figuring seed cotton at ten cents per pound profit from poisoning by the Coad method was $8.98; from poisoning by the Florida method, $13.30.

The comparative test was continued in 1924 with the addition of another one-acre plat devoted to early poisoning. We also rearranged the plats to give a check plat for each plat treated, making in all six one-acre plats. The yields found below were not favorable in 1924 to poisoning. A perfect control of the boll weevil was had from the unusually dry weather.

Growing Wilt Resistant Tomatoes for Seed Increase—In 1923 there was grown on the Experiment Station three acres of the Wilt resistant tomatoes for seed increase. From this acreage we harvested ten pounds of good seed. In the following year, 1924, a one acre plat of the Wilt resistant tomatoes gave twenty pounds of seed. All seed are distributed by the State Plant Board in their campaign against tomato wilt.

REPORT OF HORTICULTURAL WORK AT THE SOUTH MISSISSIPPI EXPERIMENT STATION FOR 1923-1924.

By W. S. ANDERSON and F. B. RICHARDSON

The investigations started here in horticulture in 1920 and carried through 1921 and 1922 and have continued with few changes and some additions during 1923 and 1924. These projects may be classed under the following headings:

1. Plant Breeding and Selections for Varietal Improvement of Fruits and Vegetalbes.
2. Fertilizer Tests.
3. Variety Tests of Fruits and Vegetables.
4. Cultural Tests with Fruits and Vegetables.
5. Storage Tests with Sweet Potatoes.

I. The work on plant breeding and selection has been in progress for four years. The increase in yield from the high producing hills of potatoes over the low producing hills makes it appear worth while. The results of this work are being reported in a circular on sweet potatoes.

II. The results of fertilizer work with sweet potatoes and tomatoes are given in separate circular.

VARIETY TESTS

III. FRUITS—In our variety orchard are included 29 varieties of apples, 2 varieties of pears, 2 varieties of quince, 3 varieties of almonds, 32 varieties of peaches, 11 varieties of plums, 10 varieties of figs ,12 varieties of citrus fruits, 24 varieties of bunch grapes, (American type,) 10 varieties of grapes (European type) 11 varieties pecans, 1 variety of walnut, 2 varieties of apricots, 6 varieties of strawberries, 3 varieties of blueberries, and in addition several varieties of various fruits which are sent here from the

office of Foreign Seed and Plant Introductions and are unnamed.

Among the new varieties of fruits received during the past two years have been several varieties of pears, raspberries, several un-named species of RUBUS and two plants of Paraguayan tea plant. (Ilex Paraguariensis). All of these have been set out in our orchard and observations are being made of their behavior. The freeze of January 6, 1924, completely killed both the tea plants. Among the berries are some that are very promising so far as growth is concerned, but no fruit has yet been produced.

We are testing cooperatively two other berries which may be promising. One is the Van Fleet raspberry, plants of which were furnished us from Washington through Prof. A. B. McKay, Horticulturalist of the A. & M. College. One year's growth of this berry makes it look promising. We are testing also the Thornless Dewberry, several plants being furnished us through the courtesy of Mr. Scott of the Pearl River Nurseries, Carriere, Miss. One seasons growth of this makes it look rather promising.

Apples, pears and other fruits in the variety test made excellent growths in 1923, and some of them produced fruit. A few fruits were ripened on the Tane Neshi persimmon, one of the Japanese group. All varieties of figs ripened some fruit in 1923, but no very creditable notes were made of any of the varieties, other than that the Black Mission bore fruit of the highest quality and of the most firm flesh, standing up better when left on the tree during rainy season than any other variety in the test. Among the varieties in the test are the Celeste, and Magnolia, which have been recommended quite generally for southern planting. These two were the most unpromising. The Celeste was injured more by the spring cold in 1923 than any other variety. In 1924 all the above named fruits made good growths and the persimmons and figs produced crops of fruit. One variety of apple, Florence Crab, ripened some fruit. Among the Japanese persimmons the Tane Nashi has been very promising this year, being closely followed by Zengi, both varieties ripening heavy crops of delicious fruits. The Tane Nashi is very large and showy as well as having a fine flavor. A good many of the fig trees were badly injured last winter by the extreme cold. This has caused the crop of fruit to be late and therefore not very much that is promising has been seen among the figs. We have observed, however, that the Green Ischia has led all others this year in withstanding freezes and in the production of fruit. The Black Mission was injured more than any other variety by the cold and produced very few fruits this year. Celeste continues to remain at the bottom of the list in fruit production, ripening very few fruits. Many fruits are set on these trees, but when they are not more than one-half inch diameter they usually shrivel and fall off. Some new varieties of figs are being tested which have been sent from the Department of Agriculture at Washington. These trees are all too small yet to bear fruit, but are making good growths.

In 1923 the grapes in the variety test made good growths and produced very creditable yields of fruit. We are testing in one plat 22 varieties of bunch grapes and 4 varieties of muscadine grapes. A careful record has been kept of the production of fruit of each variety, which has been sum-

marized and published in a separate circular.

Among the bush fruits the raspberries, Cuthbert and St. Regis varieties, were failures, not being able to carry through the summer. The Lucretia dewberry seems to be very promising. The berries are large, and a few vines bore as high as two quarts to the plant. The vines are allowed to ramble on the ground during the summer. During the winter they are tied up to a six foot stake. This facilitates harvesting, and keeps the fruit clean. After bearing, the vines are pruned off at the ground, and the prunings are removed and burned. This procedure obviates the accumulation of fungous diseases.

The plum varieties made a good growth in 1923 and some of them ripened fruit. The Munson and Excelsior ripened what would be considered a good crop of fruit for three year old trees, while Santa Rose, Improved Wild Goose, Wickson, Burbank and Mammouth Gold ripened only a few fruits During the spring of 1924 one of the Munson trees and both Excelsior trees died. All other varieties made reasonably good growths in 1924 and all produced some fruit. One Munson tree ripened 2 1-4 bushels during the period of June 15th to 30th. This variety represents the only outstanding feature of our plum variety test. In 1923 as stated above it was only one to produce a heavy crop, and this fact is interesting because the late spring cold killed all peach fruit buds and injured to a large extent the plum fruit buds in the orchard. It has been noticed that the Munson variety begins budding and blooming later than most of the other plum varieties, which makes it possible for this variety to escape the spring colds. The fruit of the Munson is large and showy, being bright yellow in color with sometimes a pink blush on one side, and has an excellent quality for eating. The skin is very thin and tender, rendering the fruit rather unfavorable for marketing purposes except where the selling is done locally and while the fruit is very fresh. It was noticed in 1923 that this fruit did not hold up well when ripening during wet seasons, the same causing the fruit to crack and spoil. A few varieties of plums from the U. S. Department of Agriculture died the second season.

All the varieties of peaches, with no exceptions, have made a vigorous growth, attaining a size at the end of the second season equivalent to a four year old tree in the North. The four races included in the variety test of peaches are the Peen-to, South China, Spanish, and North China. In 1923 a wonderful growth was made by all peach trees but no fruit was produced, except the following varieties which are members of the South China group and are commonly called "Florida peaches,": Imperial, Gibbon's October, Colon, Onderdonk, Florida Gem and Waldo. These ripened only small crops and the fruit was of inferior quality and very unpromising. The varieties of the North China group, including our most popular commercially grown peaches, made a most remarkable wood growth and would have produced fruit but for a late frost which injured the fruit buds, and in some cases, the twigs.

In 1924 a good growth has been made by all the varieties of peaches and fruit has been produced by most of the varieties. Careful records have been

kept of the observation which we have been able to make and we give below notes about the various varieties.

SUMMARY OF PEACH VARIETIES FOR 1924.

Mayflower—Ripe June 3, bore two dozen fruits, average size 2.5 x 1.75 inches. Fruit white with red blush, clingstone, fair quality, poor shipper, fair for home use or local market, has goood appearance. Tree vigorous grower.

June Elberta—Ripe June 15, bore three pecks fruit, medium size 2.25 1.87 inches. Fruit light yellow all through, semi-cling, quality good, very good for home or local market, medium for other market. Tree fairly good grower.

Early Rose—Ripe June 15, average production per tree 1.5 bushels. Fruit medium to small, red with white flesh, clingstone, quality very good ships splendidly, good for market. Tree very vigorous and very productive

Greensboro—Ripe June 15, average production per tree 1 peck, medium size 2.5 x 1.75 inches. Fruit white, clingstone, an uneven ripener, quality fair, poor for market. Tree fair producer.

Alexander—Ripe June 15, average production 1 peck, medium size 2.5 x 2 inches. Fruit red, clingstone, fair to good quality, poor shipper. Tree medium vigorous.

Jewel—Ripe June 25, average production per tree 3 pecks, small fruit 2 x 1.5 inches. Fruit white with red blush, flesh reddish tinge, free stone, poor quality, poor shipper. Tree poor grower, not promising.

Colon—Ripe July 5, average production per tree 1 peck. Fruit white with red blush, free stone, poor quality, poor shipper, not promising. Tree medium grower.

Early Mamie Ross—Ripe July 10, average production per tree 2.33 bushels, medium size 2.5 x 1.75 inches. Fruit white with red blush, semi-cling, good quality, fair shipper, fine for home and local market. Tree vigorous.

Slappy—Ripe July 10, average production per tree 1.5 bushels, medium size 2.75 x 1.87 inches. Fruit yellow, free stone, fair quality, fair for market, good for home use. Tree an excellent grower.

Hiley—Ripe July 10, average production per tree 1.1 bushels, medium size 2.5 x 1.75 inches. Fruit white with heavy red blush, flesh white, free stone, excellent quality, good for market, one of the best for local market, very popular. Tree good grower.

Alton—Ripe July 12, average production per tree 1 gallon, medium size 2.5 x 2 inches. Fruit white, semi-cling, fair to medium quality, very juicy, not firm enough for shipment, not especially promising. Tree medium grower.

Georgia Belle—Ripe July 16, average production per tree 2.3 bushels, medium size fruit 2.5 x 1.75 inches. Flesh white with red blush, free stone, excellent quality, firm tender flesh, good shipper, very popular for market and home use. Tree a good grower.

Florida Gem—Ripe July 16, average production per tree 1 bushel. Fruit very small, red, free stone, fair quality, very juicy, sweet, poor for market,

not promising on account of small size. Tree a good grower.

Early Elberta—Ripe July 25 average production per tree .5 bushels, large fruit 2.25 x 3 inches. Fruit yellow, free stone, good flavor, good for market, vigorous, not especially promising on account of low production. Tree a very good grower.

Champion—Ripe July 25, average production per tree 1 peck, fruit medium to large, white, free stone, fair, very juicy, poor for shipping, good for home orchard not promising for market. Tree good grower.

Elberta—Ripe July 25, average production per tree 1 peck, large fruit 2 x 3 inches. Fruit yellow with red blush, very showy, free stone, good quality, excellent for market and canning, does not produce regular annual crop here. Tree good grower.

J. H. Hale—Ripe August 5, average production per tree 1 peck, fruit medium size, yellow, free stone, fair quality, fair for market, not very promising here. Tree medium good grower.

Salway—Ripe September 10, average production per tree .5 bushels. Fruit medium yellow, free stone, quality good, especially promising for home orchard. Tree good grower.

Krummel's October—Ripe September 10, average production per tree 1 peck. Fruit medium yellow, free stone, very poor quality, poor shipper. Tree fair grower.

Gibbon's October—Ripe September 15, average production per tree .5 bushels. Fruit very small, white, free stone, very poor quality, very poor shipper on account of small size. Tree fair grower.

Estilla—Ripe September 10, average production per tree 1 bushel. Medium size fruit, fair quality, medium for market. Tree good grower, promising for home orchard.

The citrus trees made a good growth during the second season. Citrus scab, citrus white fly, and soft brown scale were in evidence, and it was necessary to adopt a regular spray schedule for the control of the various fungal and insect pests to which these trees are subject.

In 1923 as in the case of the other kinds of fruit the citrus varieties all made excellent growths. Some fruit was produced by nearly all the varieties in the test. The average number of fruits produced by two Tangerine trees of the Dancy variety was 52, that of the 32 Owari Satsumi trees was 10, and that of the 13 Ikeda Satsuma trees was 29. The largest number of fruits produced by a single Tangerine tree was 82, the same Owari tree was 31, the same for any Ikeda tree was 74. The size and quality of the fruit of these trees were good. Of the varieties of the round or sweet oranges in the test, the Lue Gim Gong, Parson Brown, Pineapple and Homasasa, produced a few fruits this year all of which were fair to good size. One variety of grape-fruit bore this year. The Kumquats, both Maruma and Nagami varieties, bore large crops of fruit. The Nagami appeared the more favorable of the two.

As it has always been the Station's policy, all citrus trees were mounded with dirt to a height of 12 to 15 inches about the first of December for protection against freezes. On January 6, 1924, we had a severe freeze when the

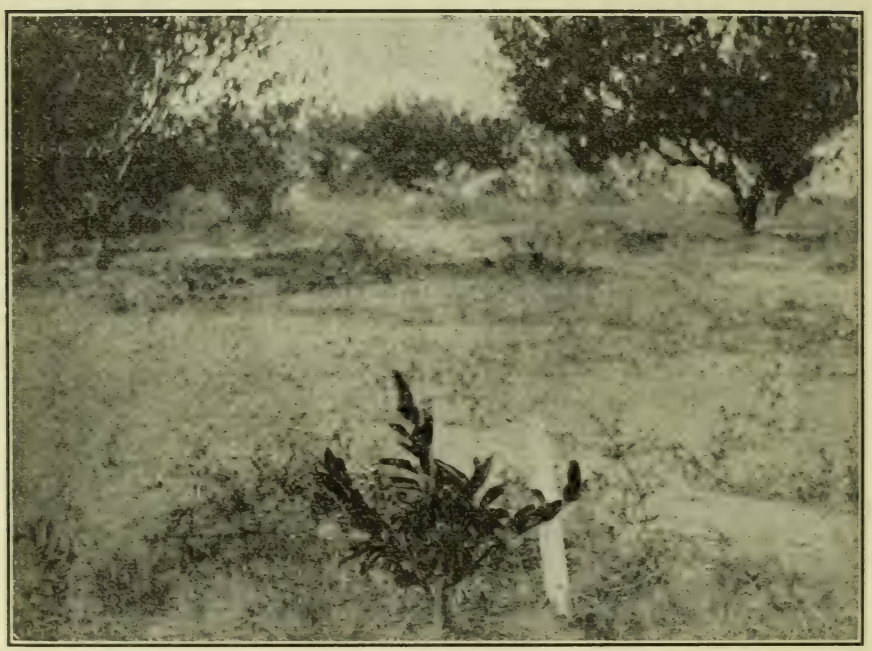
temperature dropped to 12 degrees F. and as a result all the citrus trees were injured. The Satsumas were killed back in most cases to an average of the height of the mound. The round oranges and the grapefruit trees were killed back worse than the Satsumas, and one lemon tree, the Meyer variety, was killed to within one inch of the bud union. As soon as there was no danger of cold in the spring, these banks were pulled away from the trees and the trees were immediately cut off at the top of live wood. This grove was fertilized as though the trees had not been killed back and was kept in perfect tilth throughout the growing season this year, but we varied our methods of fertilizing somewhat by applying all the fertilizer in the spring instead of making a second application in mid-summer, our belief being that this system will bring the Satsuma wood more nearly to maturity before any chances of freezes come in the winter. Out of something like 60 Satsuma trees in our planting, there seems to be at present only one which was entirely killed by the freeze. Practically all have made very fine growths this year in the form of suckers which have come out near the ground. By careful pruning we feel that we can form reasonable well shaped trees from these suckers. We are certainly convinced it is better to protect the base of the Satsuma trees with mounds and save them in case of a severe freeze. There were some skips in the plat here which were filled out in the Spring of 1924 with young trees and an opportunity was given to observe the growth of these adjacent to that of the suckers from stumps of cold-injured trees. The accompanying photographs show two trees growing in the plat 20 feet apart, one being a young tree set out after the freeze and the other being the suckers from the stump of the old tree. Note the difference in the growth made by the two. At present it is felt that the most important factor influencing cold injury to citrus groves in South Mississippi is care of the orchard, in which is included proper fertilization, cultivation, and spraying so as to render the trees perfectly healthy and vigorous when freezes come. On account of so much interest being aroused in this section in citrus growing, it is regretted that the available land for citrus planting at the station is not sufficiently large to enable us to make tests of fertilizers under citrus trees on our soils nor to run test of sprays for the control of pests of citrus trees

Satsuma orange tree with one season's growth after being killed to embankment 12 inches high by freeze at 3 years of age.

Temple Orange Tests: In the winter of 1923 we began a test of the Temple Orange in cooperation with the Buckeye Nurseries of Tampa, Florida, who furnished us with trees budded on the sour orange as stock and the rough lemon as stock. They also agreed to furnish us in the winter of 1925 and 1926 trees budded on citrus trifoliata stocks. The propagation and growing of the Temple Orange is protected for the Buckeye Nurseries by a patent and these trees were furnished us for testing ,only when we signed a contract not to progagate them or to allow them to be propagated, and agreed to render occasional reports regarding growth, etc., to the Buckeye Nurseries. The trees at the end of one season's growth are looking quite promising. They do not, however, seem as hardy as the Satsuma and may not withstand the colds that we frequently have in this section.

PRUNING EXPERIMENTS.

The studies in pruning of peach trees have been continued in 1923 and 1924 as planned by Mr. Richardson. In these tests certain trees are not pruned at all and adjacent to these are trees that are given ordinary pruning, the plan being in the case to demonstrate more than experiment. There are also certain trees which are pruned only in winter. Others are pruned in summer after fruiting time. There are still others which receive what we



Satsuma orange tree with one season's growth after setting young tree.

call ordinary pruning, meaning that they are pruned according to usually practiced methods in peach growing sections. Observations are kept of the habit of growth of the various trees after different pruning systems and the same recorded. In 1924 our first crop of fruit was harvested from these trees and we were able to notice certain differences between the habit of fruit bearing on trees under different pruning. The most interesting observations were that the trees which were not pruned at all produced from one-half to one and one-half bushels of peaches per tree more than the adjacent and properly pruned trees, and the peaches on pruned trees were from one-third to twice as large, had much better color, and were much more easily harvested than was the case of the unpruned trees. No observations of interest could be made about the difference in fruit production, owing to summer pruning instead of winter pruning. We hope to gather more notes as this work continues and be able to say definitely what are the advantages and disadvantages of the several methods of pruning which we are testing.

Sod Culture vs. Clean Culture with Figs and Peaches: Continued observations have been made during both years covered by this report of the behavior of the trees included in this work. A much greater growth has been evident on the clean culture plats than on the sod culture plats both in the case of figs and peaches. The difference is more outstanding in the case of

figs. In the Spring of 1923 a late frost, which injured fruit buds generally, killed back the figs on sod plats very much worse than on the clean culture plats, evidencing a weakness of the trees grown on the sod. In the summer of 1924 a close examination of the trees in both the plats of figs revealed that on the clean culture plats four trees or 44 1-2 per cent of the plat had an infestation of nematodes on the roots, and on the sod plat one tree or 12 1-2 per cent of the plat had an infestation of nematodes on the roots.

In 1923 no data was collected concerning the effect of culture upon nematode attacks of peaches. A careful examination was made during the month of August 1924 of roots of all trees in the peach culture tests and we found on the alternating clean and sod plats 73 per cent of the trees infested with nematodes. No nematode infestation could be found in any part of the permanent sod and continuous clean culture plats. It is, of course, impossible to draw any conclusions at this time in regard to the influence of culture upon nematode infestation, and we shall continue our observations another year.

One thing of interest has been noticed in connection with this culture test of peaches which, although not bearing upon nematode control directly, might well be mentioned. We have observed that each year the trees on the sod plats, both permanent sod and alternating sod, dropped their leaves at least two weeks in advance of the dropping from the trees in the clean culture plats. Also, which might be expected, in the following spring the trees in the sod plats bloom and bud much earlier than those on the clean culture plats, thus suggesting a possible danger to the trees on sod from late frost. This will also be noticed carefully in the future and reports made of the observations.

Effects of Sulphur applied to the Soil upon the Growth of European Grapes: In the spring of 1923 the Toyah Valley Agricultural Sulphur Company of New Orleans, Louisiana, supplied us with a quantity of sulphur compound manufactured by them and called "Tovasco." They recommended this material very highly for use in vineyards, therefore we decided to test its effect upon European grape here. We applied three-fourths of a pound around on vine in each combination of our European grapes on American stocks vineyard. No difference could be observed in the behavior of the vines in 1923, owing to the applications of this material. In 1924 one pound of "Tovasco" was applied to the same vines as in 1923 and observations made throughout the growing season failed to indicate any advantage of the application. This test will be continued further until we are convinced that either it has no value or helps when applied to vineyards.

Blueberry Tests: For the past ten years Dr. Fredrick V. Coville, Botanist for the Bureau of Plant Industry, Washington, D. C. has been working on the northern species of the blueberry, looking toward the development of varieties which would have a higher commercial value. From individual plant selections and hybridizations, Dr. Coville has developed a number of excellent blueberries, but the finest is the one he has named "Katherine" which produces a berry about the size of an ordinary Concord grape. We were able to get Dr. Coville to furnish us with two plants of his Katherine berry this year, but they came very late in the spring and although they were

carefully set out and cultivated both died before the end of the summer, owing to the fact that we had practically no rainfall after they were received. More recently Dr. Coville crossed his Katherine berry with our Southern blueberry known as "Rabbit Eye" or "Florida" blueberry. We obtained from him this year 50 seedlings of the resulting hydrid known as No. 2012, and these were also carefully planted and cared for. With a single exception all died by November 1, and we regret to say that we are unable to report any favorable data from the tests. We hope, however, that we may be able to secure additional plants of these varieties for trial another year.

Additional work was started in 1923 in the selection for the improvement of varieties by beginning plant selection in a plat of blueberries, then two years old. These blueberries are natives of Florida, being selected from the woods there and sent here to be tested under our conditions. There are evidently several different species, or at least there are such great variations both in plant and fruit characteristics as to indicate the possibility of isolating varieties. Recognizing the importance of this work, we at once planned for the selection of individual plants among the 500 or more in our plat which would have favorable characteristics. Some of the plants bore fruit in 1923 and observations were made. In 1924 a fair crop of berries was produced on the plat as a whole and excellent crops on some plants. and notes have been fully made regarding the production, size, quality, and earliness of several of the most outstanding plants. Although much time will be necessary to satisfactorily conclude this work, we feel sure that it is important in order to place the future of blueberry production on a safe basis.

A test of strawberry varieties was started here in December 1922 when plantings were made in adjacent and duplicate plats of Klondyke, Gandy, Missionary, Aroma, Lady Thompson and Progressive varieties. A reasonably good crop was harvested from the plats in 1923 and careful records kept of each variety. In 1924, although late in ripening owing to being set back by cold, a very large crop was harvested from all varieties. Although this test is too immature for any conclusions to be drawn, we give herewith tables showing the yields of various varieties for two years.

TABLE NO. IV—STRAWBERRY VARIETY TEST, SUMMARY FOR 1923-24

Name of Variety	Yield in crates of 24 pints per A. 1923	Yield in crates of 24 pints per A. 1924	Rank on basis of yields per Acre 1923	Rank on basis of yields per Acre 1924	Rank as to Commercial Desirableness	Rank as to yield Two year av'r'age	Rank as to Size
Klondyke	66	149	4	6	1	6	4
Gandy	80	229	2	2	2	2	2
Aroma	49	168	6	5	3	5	1
Lady Thompson	93	271	1	1	4	1	5
Missionary	62	172	5	4	6	4	3
Progressive	72	211	3	3	5	3	3

COOPERATIVE TESTS.

Propagation of Pear Stocks: This work was begun in cooperation with the branch Experiment Station at Talent Oregon, of which Mr. F. C. Reimer is Superintendent. He requested that we cooperate with him in an effort to

find some system by which certain pear trees used as stocks, on which the pear growers of Oregon graft their commercial varieties, can be successfully propagated. Several plans are being laid to find a successful way of propagating this stock as it would open the way for a profitable industry. Very little progress has been made with this project.

Vegetables: In 1923 we received seed of several new varieties of vegetables from the office of Foreign Seed and Plant Introductions. Among them were two species of Basella, a plant which it was believed might become a favorable substitute for spinach in the South. This plant grew well all during the summer, but only one specie, the red, produced any seed. Seed of this were saved and planted in the spring of 1924, but none came up, the inference being that they will not mature under our conditions.

Strawberry Variety Test—Summary for 1923 and 1924.

We also tried in 1923 new varieties of Kohlrabi, Endive, Salsify, Purslane, and a species of Rumex, or Dock. None of the latter vegetables were very promising and none matured any seed.

The test of the four wilt-resistant strains of tomatoes and standard varieties begun in 1921 was continued in 1922 and the results are being reported in a separate circular.

SWEET POTATO EXPERIMENTS.

For some years this Station has been experimenting with the sweet potato and its efforts have been confined mainly to variety tests, fertilizers, spacing, hill selections, cultural methods, and storage.

The results of the fertilizer test indicates that the complete fertilizer gave the greatest increase over the unfertilized plats. It further indicates that there is a gradual dropping off in yields after the first year. Well balanced fertilizers show a decrease but have maintained a yield of marketable potatoes which would give a profit to the grower.

The work on sweet potatoes is published in detail in Circular 57 from this Station.

TOMATO EXPERIMENTS

We are publishing in a separate Circular 58 the results of the tomato experiments at this Station, which consist of variety tests, fertilizers, seed selection for disease resistance, etc.

GRAPE EXPERIMENTS.

We think there are great possibilities for grape culture in South Mississippi and for this reason this Station began experiments with grapes several years ago.

We have been testing twenty-two varieties of bunch grapes and four varieties of muscadine grapes. In addition to the variety tests, we have made cultural tests, pruning tests, spraying tests, etc. Our results indicate that grapes can be grown profitably in South Mississippi.

We are publishing the results of this work in detail in Circular 59 from this Station. All of these circulars may be had by applying to the Director of Experiment Stations, A. & M. College, Mississippi.

Bulletin 226 December, 1924

COTTON EXPERIMENTS, 1924

Varieties and Fertilizers

By

J. F. O'Kelly and Roland Cowart

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

A. & M. College, Mississippi

J. R. Ricks, Director

STATION STAFF

D. C. Hull, M. Sc. ---------- President of College
J. R. Ricks, M. Sc. ---------- Director and Chief in Agronomy
M. H. Moore ---------- Secretary and Financial Agent
Hugh Critz, B. Sc. ---------- Agricultural Editor
E. B. Ferris, M. Sc. ---------- Asst Director, South Miss. Branch Station
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W. C. Morse, M. Sc. ---------- Geologist
A. B. McKay, B. Sc. ---------- Chief in Horticulture
D. C. Neal, B. Sc., M. A. ---------- Plant Pathologist
J. N. Lipscomb, M. Sc. ---------- Farm Management
J. F. O'Kelly, M. Sc. ---------- Plant Breeder
J. C. C. Price, B. Sc. ---------- Horticulturist
C. J. Goodell, B. Sc. ---------- Associate in Animal Husbandry
K. U. Jones, B. Sc., V. M. D. ---------- Veterinarian
H. W. Allen, B. Sc., M. Sc. ---------- Asst. Entomologist
R. N. Lobdell, M. Sc. ---------- Zoologist
W. S. Anderson, B. Sc. ---------- Horticulturist, South Miss. Branch Station
H. F. Wallace, B. Sc. ---------- Asst. at Holly Springs Branch Station
H. A. York, B. Sc. ---------- Asst. at Delta Branch Station
W. C. Cowsert ---------- Assistant in Dairying
H. H. Harned, M. S. ---------- Associate in Bacteriology
Roland Cowart, B. Sc. ---------- Associate Agronomist
Sid Noble, B. Sc. ---------- Publicity Agent
Miss Kittie Sue Johnson, A. B ---------- Secretary-Stenographer
Miss Fannie Page ---------- Stenographer
Miss Mary Alice Lanier ---------- Addressograph Operator
D. W. McIlwain ---------- Superintendent of Farm
D. Maxwell ---------- Foreman and Herdsman
B. V. Evans ---------- Farm Foreman, South Miss. Branch Station
J. C. Ryan ---------- Farm Foreman, Holly Springs Branch Station
J. C. Peyton ---------- Farm Foreman, Raymond Branch Station
K. C. Livingston ---------- Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. ---------- Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. ---------- Collaborator
E. C. Ewing, M. Sc. ---------- Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

COTTON EXPERIMENTS, 1924

CENTRAL STATION

J. F. O'KELLY AND ROLAND COWART

There is no doubt that the careful selection of a variety and the judicious use of fertilizers will contribute more to the income of the cotton grower than any other two factors under his control. This publication reports results on these two phases of cotton production for 1924 and, wherever possible, includes averages of several years in order that the data may be more conclusive. The results reported were obtained at the Central Station, A. & M. College and in counties surrounding Oktibbeha. Hence, they apply only to east central Mississippi.

TABLE I—SEVEN TYPES OF COTTON AT THE CENTRAL STATION

Year	Pounds Lint Cotton per Acre						
	Cook	Cleveland	Trice	Miller	Lone Star	Delfos	Express
1920	366.0	325.0	321.0	271.0	303.0	333.0	274.0
1921	555.0	552.9	470.3	497.3	516.2	443.2	440.1
1922	334.2	315.6	279.0	320.3	308.8	262.8	271.6
1923	303.5	344.4	396.5	323.8	299.2	368.9	263.6
1924	397.6	408.1	337.6	377.9	352.1	306.9	296.4
Average Pounds	391.3	389.2	360.9	358.1	355.9	343.0	309.1
Average Value	$96.61	100.47	109.83	101.70	104.14	109.90	97.88
Average Length	7-8	15-16	1 1-16	1 1-16	1 1-8	1 3-16	1 3-16
Av. Percentage	38.2	35.4	31.2	33.6	34.3	31.9	31.2

VARIETIES

Five Year Averages

There is always greater or less risk in any phase of crop production. The averages presented in Table 1 should eliminate a great part of that risk in the choice of a variety in that section of the state surrounding A. & M. College. Seven types of cotton are represented, each by the best strains the type has produced. The averages indicate that east central Mississippi should continue to grow varieties with short to medium staple. Longer varieties are justified only where the soil type is suitable and where the grower has marketing facilities which enable him to obtain a premium for staple cotton.

Salsbury and Half and Half are not included because the table consists of only those types which have been in the tests five consecutive years or more. Salsbury was not offered the station for testing until 1921 and Half and Half was omitted in 1920 because seed could not be obtained from the originator.

Variety Tests, 1924

The variety tables which follow contain practically every variety which has any promise for Mississippi conditions and many which do not but which were tried in the hope of learning the exact rating of seed being offered in

the state and elsewhere.

*The name of Willis Triumph has been changed to Willis. It has none of the characteristics of ordinary Triumph and confusion would arise from including this word in the name.

The lint prices used in computing values were obtained by averaging November 15 quotations on different lengths of middling cotton received from several dealers in different marketing centers. The seed was valued at $40.00 a ton.

No one needs to be told that the fruiting season of 1924 was the driest the state has experienced for many years, but this fact must be kept constantly in mind in studying 1924 results.

TABLE II—STANDARD VARIETIES—1924

Variety	Pounds per Acre		Lint Data			Dollars per Acre Seed And Lint	Rank In Value	Bolls per lb.
	Seed Cotton	Lint	Percentage	Length	Cents per lb.			
Trice, Miss. Sta.	1026.0	337.6	32.9	1 1-16	25.00	98.17	12	94
Trice, Burdette	771.6	256.2	33.2	1 f	24.75	73.71	22	89
Cleveland, Wan.	975.6	379.5	38.9	7-8	23.75	102.05	9	80
Cleveland, Coker	1082.4	408.1	37.7	15-16	24.25	112.45	1	79
Cleveland, Pied.	1081.2	394.6	36.5	7-8 f	24.00	108.43	5	81
Cleveland 54	1107.6	397.6	35.9	15-16	24.25	110.62	3	81
Half & Half, Lee	889.2	369.9	41.6	13-16	23.50	97.32	13	82
Cook 1346	1024.8	397.6	38.8	7-8	23.75	106.97	6	87
Willis*	1095.6	390.0	35.6	1 f	24.75	110.64	2	82
Miller	1086.0	377.9	34.8	1 1-16	25.00	108.64	4	63
Acala	996.0	375.5	37.7	1 f	24.75	105.35	8	81
D. & P. L. No. 4	970.8	372.8	38.4	1 1-16 f	25.25	106.09	7	79
Lone Star 65	1023.6	352.1	34.4	1 1-16	25.00	101.46	10	73
Lone Star 65-A2	897.6	304.3	33.9	1 1-8	26.00	90.99	18	69
Salsbury	1023.6	342.9	33.5	1 1-16	25.00	99.34	11	93
Webber 49-6	754.8	224.9	29.8	1 3-16	27.75	73.01	23	88
Webber Deltatype	895.2	260.5	29.1	1 1-4	30.00	90.84	19	81
Delfos 631	870.0	287.1	33.0	1 3-16 f	27.75	91.33	17	81
Delfos 911	930.0	306.9	33.0	1 1-8 f	26.50	93.79	15	98
Delfos 6102	907.2	303.0	33.4	1 1-8 f	26.50	92.38	16	100
D. & P. L. No. 5	907.2	296.7	32.7	1 3-16 f	27.75	94.54	14	84
Express, Lightning	822.0	258.9	31.5	1 3-16	27.00	81.16	21	94
Express 782	903.6	296.4	32.8	1 1-8 f	26.50	90.69	20	87

The test reported in Table 2 was planted on April 21 but had to be planted over on May 14 on account of some varieties having a poor stand. Dry weather damage was considerable but weevil damage was negligible. The season was favorable to medium late varieties which are often vigorous growers. The only fertilizer used was stable manure.

Bolls were very small as will be seen in those tables which report bolls per pound. The data were accurately obtained and indicate what each variety will do in a season like the one just past. They do not ,of course, represent what would happen in a normal season—nor does a great part of the

other data, as for that matter.

The sources of all seed used in these tests will be found at the end of this publication and those interested should find the list of addresses helpful.

The test reported in Table 3 is a duplication of that in Table 2 except for the omission of three varieties which had poor stands. It will be observed that no variety produced as much as 172 pounds of lint to the acre

TABLE III—HILL VARIETY TEST—1924

Variety	Pounds per Acre		Lint Data			Dollars Per Acre Seed & Lint	Rank in Value
	Seed Cotton	Lint	Per centage	Length	Cents per lb.		
Trice, Miss. Sta.	285.6	100.5	35.2	1 f	24.75	25.57	10
Trice, Burdette	234.0	82.4	35.2	15-16 f	24.40	23.14	17
Cleveland, Wan.	213.6	79.9	37.4	13-16	23.50	21.45	19
Cleveland, Coker	302.4	115.2	38.1	15-16	24.25	31.68	6
Cleveland, Pied.	336.0	126.3	37.6	7-8	23.75	34.19	4
Cleveland 54	343.2	126.6	36.9	15-16	24.25	35.03	2
Half & Half, Lee	284.4	122.0	42.9	13-16	23.50	31.92	5
Cook 1346	284.4	98.4	39.6	7-8	23.75	26.37	13
Willis	282.0	102.4	36.3	15-16	24.25	28.42	11
Miller	337.2	121.1	35.9	1 f	24.75	34.29	3
D. & P. L. No. 4	391.2	154.9	39	1 f	24.75	43.07	1
Salsbury	294.0	99.7	33.9	1 1-16	25.00	28 82	9
Webber 49-6	259.2	80.1	30.9	1 3-16	27.00	25.21	14
Webber, Deltatype	205.2	62.2	30.3	1 3-16 f	27.75	20.12	20
Delfos 631	295.2	101.5	34.4	1 3-16	27.00	31.28	7
Delfos 911	242.4	82.2	33.9	1 1-8	26.00	24.57	16
Delfos 6102	265.2	92.8	35.0	1 1-8	26.00	27.58	12
D. & P. L. No. 5	278.4	95.2	34.2	1 3-16	27.00	29.36	8
Express Lightning	249.6	82.4	33	1 1-8 f	26.50	25.18	15
Express 782	219.6	74.7	34.0	1 1-8 f	26.50	22.70	18

which is the estimated state average for 1924. The relative rank of the different varieties as to production and value is worth a great deal and the test as a whole is an excellent example of what the cotton farmer should not do. The test was planted on poor hill soil without any fertilizer just as is being done on hundreds of farms in the state every year. This practice holds the state average down more than any other one factor.

Table 4 reports a test comparing standard and new varieties. It was planted April 22 and was injured more by dry weather than any other test being reported. Some stable manure and potash were used but moisture was the limiting factor and vigorous growing varieties had the advantage.

The Central Station has conducted a considerable number of variety tests to compare the relative resistence or tolerance of different cotton varieties to the wilt disease (Fusarium vasinfectum) often called cotton blight. These tests were planted on wilt infected soil which had also been inoculated to insure uniform exposure of the plant roots to the fungus.

TABLE IV—STANDARD AND NEW VARIETIES—1924

Variety	Pounds Per Acre		Lint Data			Dollars Per Acre Seed And Lint	Rank In Value	Bolls Per lb
	Seed Cotton		Lint Percentage	Length	Cents per lb.			
Trice, Miss. Sta.	554.4	187.9	33.9	1 f	24.75	53.84	20	105
Half & Half, Lee	396.0	184.9	46.7	3-4 f	22.50	45.82	22	89
Half & Half, B. B.	531.6	240.3	45.2	3-4 f	22.50	59.90	13	81
Half & Half, Crook	510.0	215.2	42.2	13-16	23.50	56.47	18	92
Cook 588	638.4	254.1	39.8	13-16 f	23.50	67.40	7	91
Cleveland McL.	583.2	227.4	39.0	13-16	23 50	60.56	12	89
Cleveland 54	739.2	271.3	36.7	7-8	23.75	73.79	5	89
Toole, Wilkinson	554.4	209.6	37.8	7-8	23.75	56.68	17	95
Sol. & Oates B. B.	708.0	269.0	38.0	15-16	24.25	74.01	4	82
McGreer	540.0	199.3	36.9	13-16 f	23.50	53.65	21	78
Willis	580.8	213.7	36.8	7-8	23.75	58.09	14	89
Trice X Triumph	547.2	189.9	34.7	1 1-16	25.00	54.63	19	92
Evans Wonder	614.4	212.0	34.5	13-16 f	23.50	57.87	15	100
Miller, Smith	648.0	232.0	35.8	1 f	24.75	65.74	9	66
Miller	667.2	236.8	35.5	1 f	24.75	67.22	8	75
Miller, Windle	639.6	232.8	36.4	15-16 f	24.40	64.94	10	79
Lone Star, Saun.	688.8	272.1	39.5	1 1-16	25.00	76.36	2	64
Lone Star, Chris.	692.4	283.2	40.9	1 1-16	25.00	78.98	1	62
D. & P. L. No. 7	595.2	223.2	37.5	1 1-16	25.00	63.24	11	73
D. & P. L. No. 8	663.6	278.0	41.9	1	24.50	75.32	3	84
D. & P. L. No. 6	608.4	227.5	37.4	1 1-8 f	26.50	67.91	6	97
Burdette Express	588.0	188.7	32.1	1 1-8	26.00	57.05	16	116

The results obtained from the wilt test in 1924, when the wilt injury was the worst experienced in several years, are given in Table 5. The rank of these varieties in apparent resistance to the disease was: Cook, Rhyne; Cook 307-6; Solomon and Oates Big Boll; Dixie Triumph; Toole, Wilkinson;

TABLE V—TEST FOR WILT RESISTANCE, 1924

Variety	Lbs. per A		Lint Data			Dollars per Acre Seed & Lint	Rank In Value
	Seed Cotton	Lint	Percentage	Length	Cents per lb.		
Miss. Sta. Trice	468	156.8	33.5	1 f	24.75	45.03	14
Half & Half, Mahon	462	200.0	43.3	3-4 f	22.50	50.24	10
Cook 307.6	672	260.7	38.8	13-16	23.50	69.49	3
Rhyne's Cook	705	274.2	38.9	13-16	23.50	73.06	1
Sol. & Oates B. B.	567	214.9	37.9	7-8 f	24.00	58.62	7
Wilkinson Toole	489	175.6	35.9	15-16 f	24.40	49.12	11
Dixie Triumph	585	212.9	36.4	15-16 f	24.40	59.39	5
Clev'd X Lewis 63	579	218.3	37.7	7-8	23.75	59.06	6
Cleveland 54	582	208.4	35.8	15-16	24.25	58.01	8
Willis	621	222.3	35.8	15-16 f	24.40	62.21	4
Miller	717	245.2	34.2	1 1-16	25.00	70.74	2
Lone Star, Saun.	513	192.9	37.6	1 1-16	25.00	54.63	9
Salsbury	474	158.8	33.5	1 1-16 f	25.25	46.40	12
Delfos 911	450	147.2	32.7	1 1-8 f	26.50	45.07	13

Miller; Cleveland 54; Salsbury; and Willis. Other varieties should be classed as susceptible except the hybrid ClevelandXLewis 63 of which there are no seed for distribution. In other years Covington Toole, Express, and Watson's Long Staple have shown much resistance.

Several of the varieties named have been tested at the different branch stations on soils not infected with wilt and the results have been published in bulletins and circulars already issued by the Experiment Station. The other varieties have been tried only at the Central Station, A. & M. College, and the reader should bear in mind that these results cannot be applied without qualification to other parts of the state.

The fact that a variety is very resistant to wilt is no indication that it will always produce high yields under wilt conditions. In fact, the Station has experienced considerable difficulty in finding resistant varieties which also yield well. Under moderate wilt infection and favorable weather conditions, susceptible varieties have occasionally produced more before being checked by the disease than resistant varieties. Varieties possessing resistance are being improved, however, and the list given contains several varieties which should give satisfactory results.

This Station has no fertilizer results which indicate conclusively that the application of any particular fertilizer will have a fungicidal effect on wilt. It is believed, however, that if the soil is deficient in any particular plant food whether it be phosphorous, nitrogen or potash, supplying the deficient element should aid the plant in resisting disease.

Results were obtained on five cooperative variety tests in as many counties and acknowledgement is here made for the helpful cooperation of county agents and farmers. The yields are given in Table VI.

The Clay County test was planted on the farm of Jack Horner April 21. The soil was black sandy loam and 200 pounds nitrate of soda to the acre was applied to the test June 11. Willis and Acala had a poor stand and Delfos had a very poor stand.

The Lowndes County test was planted on the farm of J. H. Hardy May 14. The soil was black bottom prairie and 175 pounds nitrate of soda to the acre was used. This is doubtless as accurate as any test in the group. The fruiting season was nearly ideal, the stand of all varieties was excellent, and there were six replications or series.

The test in Noxubee County was planted on red post oak soil April 28. Fertilizer used was 100 pounds acid phosphate and 100 pounds nitrate of soda to the acre. All varieties had a good stand.

In Lauderdale County the test was planted on sandy loam soil of the short leaf pine area, April 26. The fertilizer used was 400 pounds to the acre of a mixture of two parts acid phosphate and one part nitrate of soda. Cleveland, Wannamaker was reported as having a poor stand.

The Madison County test was planted on the farm of Hugh Winans April 24. The soil was Grenada silt loam and received 450 pounds to the acre of a mixture of 200 pounds acid phosphate, 100 of nitrate of soda, and 50 of kainit.

The list of varieties used in the cooperative tests just reported contains practically everything that deserves consideration in this section of the state. It is hoped this work can be continued with sufficient thoroughness that in a short while the number of varieties for this section can be narrowed to four or five or even less.

TABLE VI—COOPERATIVE VARIETY TESTS—1924

Variety	Pounds Seed Cotton to the Acre County					Lint	
	Clay	Lowndes	Noxubee	Lauderdale	Madison	Length	Percentage
Trice, Miss. Sta.	1205	1510.0	638.2	1095	1209.0	1 1-16	32.9
Half & Half, Lee	1020	1467.5	587.4	1035	930.0	13-16	41.6
Cleveland, Wan.	1200	1532.5	577.9	720	799.8	13-16f	38.9
Cleveland 54	1130	1607.5	568.3	1005	1153.2	15-16	35.9
Cleveland, Pied.	1065	1513.5	616.0	870	1060.2	7-8	36.5
Cleveland, Coker	985	1483.5	562.0	975	967.2	15-16	37.7
Cook 219	1120	1637.5	609.6	930	1041.6	7-8	38.8
Willis	1025	1517.5	590.6	1020	1116.0	1 f	35.6
Miller	1115	1661.0	663.6	795	967.2	1 1-16	34.8
Acala	800	1463.5	577.9	885	985.8	1 f	37.7
Salsbury	1165	1515.0	609.6	900	1153.2	1 1-16	33.5
Delfos 6102	910	1327.5	625.5	915	1023.0	1 1-8f	33.4

Note—The length and percentage figures were taken from the work at A. & M. College and must be treated as approximations.

FERTILIZERS

A test comparing four nitrogen carriers has been conducted for four years and the results are presented in Table VII. Cottonseed meal has always been applied before planting and the other carriers have been applied as side dressings after the cotton was hoed.

TABLE VII—NITROGEN SOURCES TEST

Fifteen Pounds Available Nitrogen to the Acre from:	Pounds Seed Cotton per Acre Increase					Value Less Fertilizer Average
	1921	1922	1923	1924	Average	
Ammonium Sulphate	154.7	91.2	208.8	163.5	154.6	$14.15
Nitrate of Soda	187.0	88.0	270.3	132.0	169.3	14.91
Calcium Cyanamid	173.5	63.6	228.0	44.3	127.4	11.03
Cottonseed Meal	4.7	46.2	118.4	69.0	59.6	2.82

The results indicate very clearly that the best nitrogen carriers will be profitable when applied at the rate of 100 pounds of nitrate of soda to the acre or its equivalent in another form.

Cotton rust is a reaction of the plant to soil conditions unfavorable to normal development, one of these conditions being insufficient potash in the soil. The Station has used potash in the form of kainit for rust control for

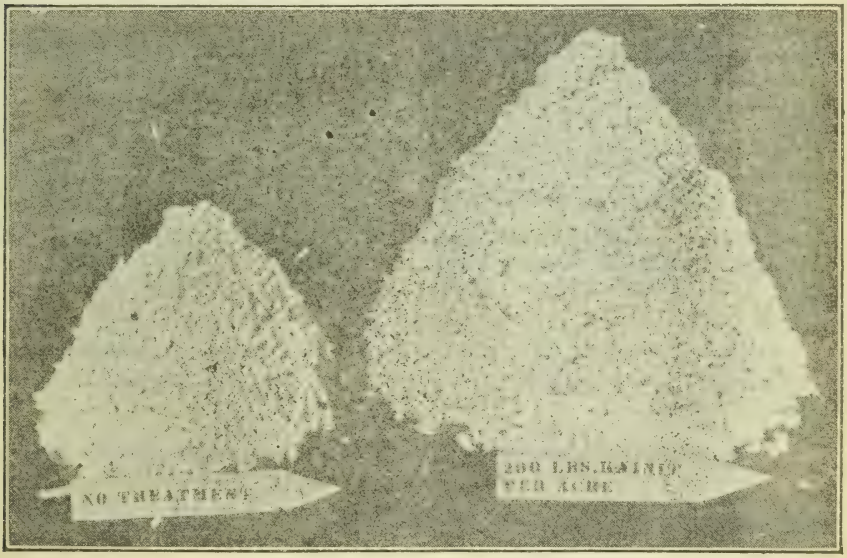
two years and the results are given in Table VIII. Seed cotton was valued at eleven cents a pound in 1923 and eight cents in 1924. Kainit was valued at cost.

Another trial in 1924 compared kainit and kemfert on soil where rust is not extremely severe. Each was applied at the rate of 24 pounds K20 to the acre, the calculated amount being based on 12% kainit and 58% kemfert. The increase was 110.4 pounds seed cotton to the acre for kainit and 109.2 pounds for kemfert. The difference between the two forms is negligible and the increase indicates that potash is profitable even where rust damage is only moderately severe.

TABLE VIII—POTASH FO RUST CONTROL—AVERAGE 1923-24

Treatment	Pounds Seed Cotton per Acre		Value Increase in Dollars	
	Total	Increase	Total	Less Fer.
No Fertilizer	330.3	--	--	--
200 Lbs. Kainit to the Acre	892.5	562.2	55.31	53.65

Experiments indicate that potash in the form of the sulphate or the chloride is as efficient pound for pound of potash as kainit. The form to be used should be determined by first costs, freight rates, and mileage to be hauled from railway delivery point to the farm.



Note—The above cut represents the difference in yield from the use of potash reported in Table VIII. No other fertilizer was used.

For some time it has been known that fertilizers are necessary for profitable cotton production in the short leaf pine area and that the soil in that section responds to the use of fertilizer. There has, however, been some doubt as to the kinds and quantities which would be most profitable. Accordingly, the test reported in Table IX was begun with the object of determining the facts in the case.

When two kinds of fertilizers are required, the rate at which one may prove most profitable depends, to some extent, on the rate at which the other is used. Because of this the rates of phosphorous and nitrogen were varied as indicated in the table. There were four replications on a hillside as nearly uniform as could be found. The corrected yields are based on the average of all check plots and are probably a little more accurate than the actual yields. However, the latter are given for the benefit of those who may want to use them. The columns headed Increase, Per cent Increase, and Values are based on the corrected yields.

TABLE IX—PHOSPHORUS AND NITROGEN TEST—CHOCTAW COUNTY

Fertilizer and Pounds per Acre	Pounds Seed Cotton per Acre			Per Cent Increase	Val. Increase Seed Cotton 8 Cents	
	Actual Yield	Corrected Yield	Increase		Total	Less Fert.
None	215.3	235.5	----	----	----	----
200 Acid phos., 100 Nitrate Soda	684.0	693.1	457.6	194.3	36.61	32.40
300 Acid phos., 100 Nitrate Soda	734.3	693.4	457.9	194.4	36.63	31.69
400 Acid phos., 100 Nitrate Soda	702.0	620.3	384.8	163.4	30.78	25.11
None	283.5	235.5	----	----	----	----
200 Acid phos., 200 Nitrate Soda	643.5	552.9	317.4	134.8	25.39	18.43
300 Acid phos., 200 Nitrate Soda	746.3	663.7	428.2	181.8	34.26	26.57
400 Acid phos., 200 Nitrate Soda	786.0	724.8	489.3	207.8	39.14	30.72
None	246.0	235.5	----	----	----	----
200 Acid phos., 300 Nitrate Soda	789.0	794.7	559.2	237.5	44.74	35.03
300 Acid phos., 300 Nitrate Soda	836.3	888.4	652.9	277.2	52.23	41.79
400 Acid phos., 300 Nitrate Soda	804.8	904.7	669.2	284.2	53.54	42.37
None	197.3	235.5	----	----	----	----

Note—The Farm Management Department under the direction of J. N. Lipscomb rendered valuable assistance in locating this test and in collecting field weights.

There are some inconsistencies in this test, especially in those yields near the second check, but as a whole it is convincing. In every case the fertilizer paid well; in every case it increased the yield more than 100%; and, with the extremely dry season, 700 pounds to the acre, which was the heaviest mixture, was most profitable.

It may be worth while to mention the fact that in each group of three plots where nitrogen was used at the same rate the most profit was obtained

where the mixture approached nearest a ratio of 8% phosphorous and 4% nitrogen. This may be more of an accident than an experimental fact but it has been found true in certain other sections of the South and further trials will settle the question in this case.

Table X reports results from a nitrate rate and dates test conducted in the flatwoods section of Oktibbeha County. The results, as a whole, indicate that the use of nitrogen under such conditions will be profitable. They are, however, too inconsistent for definite conclusions. The inconsistencies are due mainly to a seed bed too low for good drainage early in the season and crop damage by much grass and weeds at first hoeing.

TABLE X—NITRATE RATES TEST—FLATWOODS SECTION

Pounds Nitrate of Soda to the Acre and Time of Application	Pounds Seed Cotton per Acre			Per Cent Increase	Val. Increase Seed Cotton 8 Cents	
	Actual	Corrected Yield	Increase		Total	Less Fert.
None	460.2	481.1	----	----	----	----
100 Before Planting	570.0	592.0	110.9	23.1	8.87	6.13
100 After Hoeing	652.8	673.7	192.6	40.0	15.41	12.66
50 Before Planting and 50 After Hoeing	607.2	622.6	141.5	29.4	11.32	8.57
None	472.2	481.1	----	----	----	----
150 Before Planting	612.6	617.1	136.0	28.3	10.88	6.75
150 After Hoeing	616.2	613.8	132.7	27.6	10.62	6.49
75 Before Planting and 75 After Hoeing	685.8	675.5	194.4	40.4	15.55	11.42
None	493.8	481.1	----	----	----	----
200 Before Planting	713.4	693.5	212.4	44.1	16.99	11.49
200 After Hoeing	664.2	644.4	163.3	33.9	13.06	7.56
100 Before Planting and 100 After Hoeing	661.8	640.6	159.5	33.2	12.76	7.26
None	498.0	481.1	----	----	----	----

SEED SOURCES, 1924

Acala—L. E. Gleeck, Box 334, Memphis, Tenn.
Cleveland, Coker—Pedigreed Seed Co., Hartsville, S. C.
Cleveland, McLendon—C. A. McLendon, Atlanta, Ga.
Cleveland Wannamaker—Model Seed Farms, St. Matthews, S. C.
Cleveland, Piedmont—Piedmont Pedigreed Seed Farms, Commerce, Ga.
Cleveland 54—Miss. Exp. Station, A. and M. College, Mississippi.
Cook, Rhyne—Rhyne Bros., Benton, Alabama.
Cook 1346—E. F. Cauthen, Auburn, Alabama.
Cook 219—E. F. Cauthen, Auburn, Alabama.
Cook 307-6—Ala. Experiment Station, Auburn, Alabama.
Cook, 588—Robert Hudson, Auburn, Alabama.
D. & P. L. No. 4—Delta Pine Land Co., Scott, Miss.
D. & P. L. No. 5—Delta Pine Land Co., Scott, Miss.
D. & P. L. No. 6—Delta Pine Land Co., Scott, Miss.
D. & P. L. No. 7—Delta Pine Land Co., Scott, Miss.
D. & P. L. No. 8—Delta Pine Land Co., Scott, Miss.
Delfos 631—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 6102—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 911—Delta Branch Experiment Station, Stoneville, Miss.
Dixie Triumph—L. O. Watson, Florence, S. C.
Evans' Wonder—Evans & Evans, Prairie, Miss.
Express, Burdette—Burdette Plantation, Burdette, Ark.
Express, Lightning—Pedigreed Seed Co., Hartsville, S. C.
Express, 782—Delta Branch Experiment Station, Stoneville, Miss.
Half & Half Big Boll—N. E. Cleveland, Stratton, Miss.
Half & Half, Crook—Crook Bros., Luray, Tenn.
Half & Half, Lee—M. B. Lee, Corinth, Miss.
Half & Half, Mahon—H. K. Mahon, Holly Springs, Miss.
Lone Star, Chris.—R. W. Christian, Manchester, N. C.
Lone Star, Saun.—D. A. Saunders, Greenville, Texas.
Lone Star, 65—Mississippi Experiment Station, A. & M. College, Miss.
Lone Star, 65-A2—Stoneville Pedigreed Seed Co., Stoneville, Miss.
McGreer—D. C. McGreer, Decatur, Miss.
Miller—Miss. Experiment Sta., A. and M. College, Miss.
Miller, Smith—Joe Smith, Guntown, Miss.
Miller, Windle—Norton Windle, Blue Springs, Miss.
Salsbury—Delta and Pine Land Co., Scott, Miss.
Sol. & Oates B. B.—Soloman and Oates, Headland, Ala.
Toole, Wilk.—C. F. Wilkinson, Headland, Ala.
Trice, Burdette—Burdette Plantation, Burdette, Ark.
Trice, Miss. Sta.—Miss. Experiment Sta., A. and M. College, Miss.
Trice X Triumph—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Willis—Hinds Co. Farm Bureau, Jackson, Miss.
Webber Deltatype—Pedigreed Seed Co., Hartsville, S. C.
Webber 49-6—Pedigreed Seed Co., Hartsville, S. C.

Bulletin No. 227 June, 1925

SOYBEANS

DELTA BRANCH STATION

By

W. E. AYRES

Fig. 1: Otootan Soybeans planted in 3 ft. rows on coco infested, buckshot soil yielding about 3 tons of hay per acre.

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F. O. CORK, B. Sc.....Supt. Farm Management Vocational Project
D. MAXWELL.....Foreman and Herdsman
MISS MARY ALICE LANIER.....Addressograph Operator
H. B. BROWN, Ph. D.....Collaborator
E. C. EWING..... Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept of Agr.

SOYBEANS

DELTA EXPERIMENT STATION

By W. E. Ayres

The soybean (soy bean, soya bean, or soja bean) bids fair to become one of the leading crops of the Delta, if not the State. It is therefore proper that a portion, at least, of the available knowledge of the crop be summarized for the benefit and use of farmers and others interested. The aim of this resume is primarily to present the soybean information to the agricultural interests.

The soybean originated in Eastern Asia, probably in Manchuria, China, or Korea. It is referred to botanically as Glycine Hispida, Glycine Max, and Soja Max, the latter being the latest American nomenclature. Soybean literature is abundant, there being between 12,000 and 14,000 papers and volumes on the subject.

The importance of the crop is increasing very rapidly as indicated by Table 1 compiled from year books of the United States Department of Agriculture. In 1917 the United States only planted 460,000 acres for all purposes. This was a 50% increase over 1916 planting. Table 1 shows 168,000 acres for seed purposes. This was only 20% of the total 840,000 acres planted for all purposes. In 1924 2,566,000 acres were planted for all purposes. This is an increase of 736% over the 307,000 acres planted in 1916, and a 20% increase over 1923. The increase of the 1925 acreage over that of 1924 is more than 25%.

The growth of the soybean area in Mississippi has been very rapid. In 1920 only 4,000 acres are reported. The 1924 planting was 110,000 acres. This is an increase of 2,650% in 5 years, and a 144% increase over 1923. The 1925 increase is still greater. The growth of Delta acreage has been even more rapid than that of the State as a whole. The growth will, in all probability, increase even more in the future as mechanical harvesters are perfected, and oil mills in this section begin to crush the seed for oil and cake.

The soybean has been important in commerce for many years. In 1923 the United States imported 38,635,000 pounds of soybean oil and much cake and meal. The trade in soybean products between the Orient and other countries producing less cottonseed oil, meal, and cake than the United States is enormous.

TABLE I—ACREAGE, PRODUCTION, AND PER ACRE YIELD OF SOYBEAN SEED 1919-23

STATE	Thousands Of Acres Harvested					Five Year Average		
	1919	1920	1921	1922	1923	Acres	Bushels	Bushels Per Acre
North Carolina	82	91	113	100	105	98,200	1,641,000	16.6
Illinois	6	8	6	65	92	35,400	465,800	12.1
Missouri	6	7	4	15	70	20,400	254,200	14.0
Virginia	30	30	12	13	14	19,800	351,200	17.2
Ohio	2	8	8	31	50	19,800	279,800	10.6
Alabama	7	23	9	18	17	14,800	141,200	9.8
Indiana	2	3	4	20	40	13,800	184,200	13.0
Kentucky	7	8	6	6	6	6,600	88,800	13.4
Tennessee	2	5	8	6	6	5,400	46,400	8.2
Mississippi	8	1	2	8	8	5,400	73,800	13.5
Michigan		8	7	4	6	5,000	51,800	10.3
Wisconsin	1	4	4	7	4	4,000	36,000	9.5
Iowa				6	10	3,200	60,400	19.5
Georgia	2	2	1	3	7	3,000	34,800	11.4
Maryland				5	7	2,400	40,400	16.8
South Carolina	1	1	1	3	5	2,200	23,800	9.8
Delaware				2	3	1,000	15,000	14.9
Louisiana		1	1	1	1	800	11,000	13.9
Pennsylvania	2					400	7,200	18.0
West Virginia				1	1	400	6,000	15.0
United States	168	190	186	314	452	262,000	3,817,800	14.5

SOIL AND CLIMATIC CONDITIONS

Soybean growing is simpler than the production of any other common field crop. Soybeans may be grown successfully from the gulf coast to central Illinois. The varieties which are most profitable vary with the latitude, of course. The wettest arable Delta soils produce profitable crops of soybeans. Profitable crops were produced in 1924 when practically no rain fell from May to November. In 1923 when the rainfall was excessive, soybeans did well where other crops failed. The crop will stand much more extremely dry or extremely wet weather than either cotton or corn. IT IS THE DELTA'S SAFEST FEED CROP.

The soybean is adapted to practically all Southern soils. In the Delta it does well on all types of soil, from the worst buckshot to the lightest loam.

PRODUCING THE CROP

Seed Bed: A good seed bed is best but thorough disking is sufficient to produce good crops. There is little data available to indicate whether or not such preparation as should be practiced for corn is even desirable. At the Station good crops have been produced on land

which was only thoroughly disked but the plants seem better able to compete with weeds when a good, deep, seed bed is prepared. No soybeans or other crops should be planted amongst clods. The surface should at least be in good tilth, whether the seed bed is deep or not. On low lands soybeans should be planted on low beds, if planted in drills early.

Planting Dates: Soybeans may be safely planted in this latitude from March 25th to July 15th. Earlier planting will often survive since soybeans are hardy after the plants are a few days old. Any time after the plants are five days old they will stand a light frost—temperatures of 29 to 30 degrees F. or even less (nobody seems to know just how low a temperature they will stand). There are many volunteer beans on the Station which withstood a temperature of 28 degrees F. about March 10th. None of the volunteer crop on the Station was injured March 31, 1924, except those plants less than four days old. The frost was quite severe, as most planters will remember.

The early plantings are safest because of two factors. Soybeans tend to mature near a certain date (this date being dependent upon variety) regardless of the date of planting. Said another way, the difference between the dates of maturity of a certain variety planted on different dates is not nearly so great as the difference between the planting dates. Otooton beans planted May 9, 1923 only matured four or five days earlier than those planted June 22nd. The early plantings produce larger hay yields because of the longer growing period. The very early plantings get a better early start and are better able to compete with weeds and grass for space, plant food and moisture.

Early planting has another distinct advantage from the farm management standpoint. There are usually a few leisure days the last of March and the first of April on every cotton farm. The soybean crop must be planted during this time, compete with cotton planting for labor, or wait for planting until after all cotton is planted. If the land is to grow no other spring or summer crop than soybeans, it is best to plant them between the 25th of March and cotton planting time.

On land which grows oats, soybeans should either be planted with a grain drill in the oats during the above period, or planted on a well prepared seed bet immediately after the oats are harvested. Land growing other winter or spring crops should be planted as soon after the crops are off as possible. Good seed beds are very desirable for late plantings.

The Delta Station began a test of dates of planting in 1924. Unfortunately, no plantings were made until May 1st and no seed germinated after the June 1st planting. The yields of seed from duplicate

plots were as follows:

Laredos planted May 1st, 11.30 bushels; May 10th, 11.03 bushels; May 20th, 12.56 bushels; June 1st, 10.28 bushels; an average of 11.29 bushels per acre. Biloxi planted May 1st, 12.09 bushels; May 10th, 10.46 bushels; May 20th, 10.07 bushels; June 1st, 12.15 bushels; an average of 11.19 bushels per acre. Otootans planted May 1st, 4.47 bushels; May 10th, 4.70 bushels; May 20th, 4.07 bushels; June 1st, 7.62 bushels; an average of 5.22 bushels per acre.

This test is being continued with plantings made from March 15th to July 15th. Laredo, Virginia, Biloxi, and Otootan are the varieties used. It will be noted that Otootan and Biloxi produced more seed from the June 1st plantings in 1924. The early varieties usually produce more seed and more hay when planted early. Late varieties, such as Otootan, make more hay when planted early, but often the late plantings (May 20th to June 20th) produce more seed than early plantings.

Inoculations: Soybeans may be inoculated in various ways. The cheapest way is to obtain about a gallon of soil for each bushel of beans to be inoculated from a field known to be inoculated. This should be thoroughly dried in the shade, crushed and mixed with the beans. If the seed are moistened less soil will be required.

Pure cultures may be obtained from seedsmen or direct from the manufacturers. Full directions for using are sent with each bottle. The important point in using cultures is to be sure the source of supply is reliable. When seed are inoculated by either method, it is necessary to avoid direct sunlight. The seed must not be exposed to direct sunlight from the time they are inoculated until planted.

When soybeans have been grown on land previously, it is not necessary to inoculate the seed to be planted. The belief has been rather general in the South that all Southern soils were inoculated for soybeans. Most Southern soils are, but there were many soybeans failures in 1924, due to lack of inoculation. It is much safer to inoculate and the cost of inoculation is too small to justify the risk on land not known to be inoculated. Figure II shows nitrogen—adding nodules on a well inoculated plant.

Methods of Planting: Soybeans may be grown successfully alone, either in rows or broadcast. Good crops have been obtained on the Station from soybeans planted in oats, in corn, and from volunteer crops.

When soybeans are planted on land the first time, it is safer to inoculate the seed, plant in rows, and cultivate. This is especially true when the soil is thin, weedy, or grassy. After Delta land, or any other comparatively good land, has grown soybeans one year and becomes thoroughly inoculated, broadcast seeding is cheapest and safest.

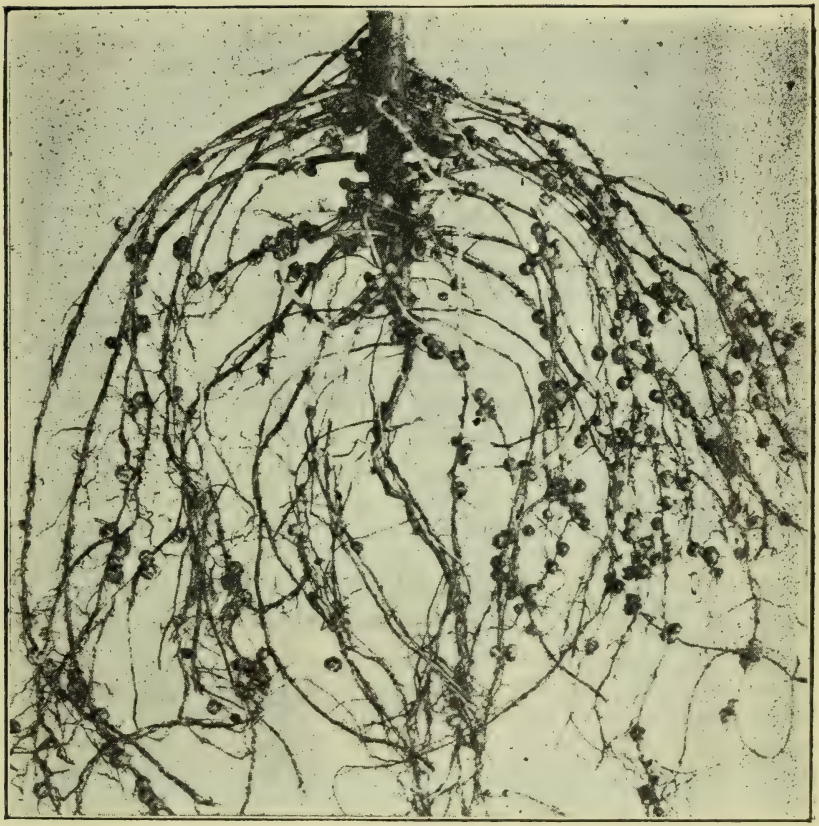

Fig. 2: Root of well inoculated soybean plant showing bearing nodules in abundance.

unless the land is badly infested with burrs or other rank growing weeds or grass. This is especially true if the beans can be planted before April 10th so they get started ahead of other vegetation.

If soybeans are planted broadcast on areas badly infested with coco, the rate of seeding recommended should be increased 50%. The soil should be thoroughly prepared and the beans planted between March 25th and April 10th. They must have an even start with coco. It is very important that sufficient moisture be present when the seeds are planted to insure prompt germination.

In the Delta, soybean rows should be about three feet wide. On poorly drained soil it is safest to plant on low beds, if early planting is practiced. Ordinary corn planters equipped with proper plates, plant soybeans satisfactorily. Where duplex hoppers are available, they are most satisfactory.

If soybeans are planted in rows on level land, seeding with the grain drill is the most economical method. Enough holes may be stopped to give the proper space between rows. In some areas two holes are left open and three stopped. This plants two rows eight inches apart, with 32 inches between the outside rows. In this way only one side of each row is cultivated. This method looks good, but the writer knows nothing about it in practice.

Depth of Planting: Before small seeded varieties were generally known, it was common knowledge that soybeans often germinated very poorly. This was especially true if they were not planted very shallow. The large seeded varieties often "break their necks" getting out of the ground, if planted a little too deep and a rain comes and a crust forms before the seeds germinate. It is difficult, at best, to get a stand of the large seeded varieties. Planting too deep increases this difficulty. Beans planted about an inch deep are more likely to produce stands than those planted at other depths.

The small seeded varieties, such as Laredo and Otootan, seem able to come through much deeper layers of soil than Mammoth Yellow and similar varieties. Land plowed from 5 to 7 inches deep and section harrowed in February 1925 has a perfect stand of volunteer Laredo Beans on it now. The 1924 crop was cut for hay and there was not an excessive amount of shattered beans on the ground. If the ground had been disked, it would be possible that the beans were brought to the surface by the disk. Volunteer plants have been dug up, which had come through three or four inches of soil. The above mentioned small seeded varieties have always given better and quicker stands than corn, when planted with the corn at the same depth. Too deep planting should be avoided even with small seeded varieties, but they may be planted with safety under average conditions up to 2½ inches, and probably deeper.

Volunteer Crops: In the spring of 1923, two acres of poorly drained, coco infested buckshot, Station land was planted in Laredo Soybeans for seed. They were cut with a mower October 12th. After they were hauled in the land was disked thoroughly and planted to Red Rust Proof Oats at the rate of 10 pecks per acre. Throughout the winter a volunteer stand of beans appeared after every warm spell of weather. These were killed by following freezes, but those which germinated after March 25th remained and were topped by the binder when the oats were cut.

Within three weeks after the oats were off the land, the soybeans had overcome all weeds and grass and were doing fine. They were cut for seed in October and the land again planted to oats. The winter of 1923-24 was very severe and the fall dry. Notwithstanding the severity of the winter, another volunteer stand appeared and produced a good crop.

Late in the spring of 1924 another buckshot area was planted to corn and soybeans. Otootans, Biloxis and Laredos were used. The stand of corn was very poor and hay scarce in the fall. The entire area was cut for hay. In February 1925, the land was plowed 5 to 7 inches deep and section harrowed. By March 25th a good stand was up on the entire Laredo area. Otootans have volunteered to some extent, but no full stands have been obtained, either on seed fields or where they have been grazed.

Two Hay Crops from Early Plantings: Oats in small areas of the volunteer Laredo field did not freeze out in 1924. These were cut with the mower. The oats were thin and the beans practically as tall as the oats. The cutting was done at different heights. There was no rain at all for six or eight weeks after the cutting was done, but those areas cut four inches high or higher, suckered and produced a better fall crop than those which were not cut. They seemed to withstand the dry weather better. The plants cut as low as two inches did not die for two or three weeks. It was evident that a rain would have saved them.

In 1925, a portion of the volunteer area was cut as nearly 4 inches high as possible on June 1st, and another portion on June 11th. Both areas bid fair to make good fall hay crops.

It seems entirely possible and practicable to expect two hay crops from plantings made prior to April 5th on good land, if the first cutting is made above the first branches. The first cutting should be made not later than June 20th. More experiments and observations are to be made and other varieties included in the work.

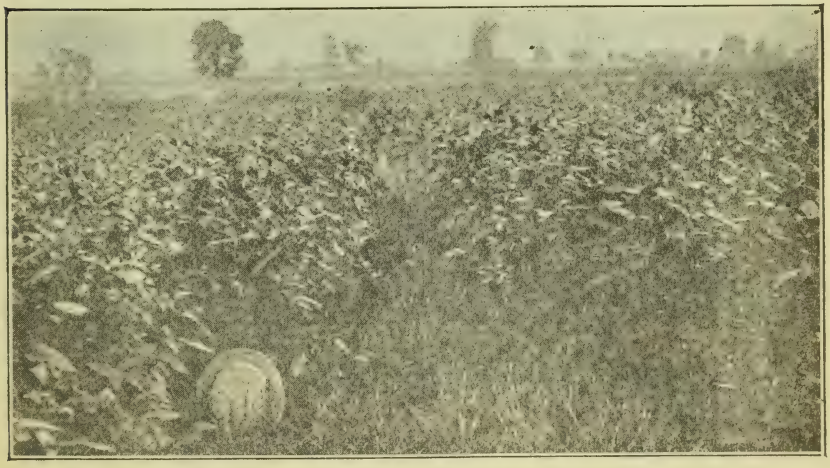

Fig. 3: Left, Laredo; right, Otootan Soybeans planted in fall oats with a grain drill, April 5, 1924. The oats were cut with a binder about June 1st. Photographed September 1st.

Planting in Oats: The volunteer crops produced in good crops of oats led to tests with beans planted in fall sown oats. On March 20, 1924, plots of Laredos and Otootans were planted in fall sown oats with a grain drill. Other plots of the same varieties were planted April 1st and 10th. Figure III shows the plots planted April 1st. The photograph was made September 1st, following an extremely dry summer. Good stands were obtained from all plantings. The oats were cut about June 10th. There was no rain from the time the oats were cut until the beans were harvested. The first plantings were best until the middle of July, but the late plantings seemed to hold up best after the drought became extremely severe. The plantings made in oats in 1925 were in spring oats, all the fall planted oats having been winter killed. They were planted after the April showers. There was not enough moisture for germination, but enough to start them and cause them to fail to germinate. Plantings made with small seeded varieties between March 25th and April 10th on fall oats are comparatively safe. This method of handling facilitates feed production in that the beans do not compete with cotton for labor in the spring.

Fig. 4: Otoctan Soybeans planted between the hills of corn with a duplex hopper on a Shawnee Planter.

Planting in Corn: Unless there is a special reason why it should not be done, every acre of Delta corn should be planted to beans at planting time. Table II shows that more grain—soybeans and corn—was produced where both soybeans and corn were planted together at corn planting time than where corn was planted alone. The plot on which the beans were planted in the corn, three weeks after planting the corn, produced the average record yield of grain but this would not be true if the beans could have been saved in 1922. The percentage of bean failures is too high when this is practiced and the labor cost too high. The yield of forage is also much less and the increased yield of future crops correspondingly less also.

The question of what the earliest safe date of planting is comes up every spring. As previously stated, soybeans withstand comparatively low temperatures after they are a few days old. Some experimenters in the Northern States believe soybeans will stand colder weather than corn. This has not been the observation of the writer, unless the cold weather comes after the plants are more than five days old. They are hardy enough, however, and will probably escape injury nine years out of ten, if planted as late as March 25th. It is cheaper to plant both at the same time, everything considered, if the corn is to be planted as late as March 10th. Occasionally the beans will get killed and the corn survive. When this happens the beans can then be dropped between the corn plants when the corn is thinned and covered as the corn is plowed.

TABLE II—CORN AND SOYBEANS IN COMBINATION 1921-2-3-4

Combination Used	Bushels of Grain per Acre				
	1921	1922	1923	1924	Average
Yield of Corn					
Corn 24" Beans between hills at planting	18.0	23.4	23.5	5.7	17.7
Corn alone 24" in the drill	21.1	34.9	28.4	12.4	24.2
Corn 24" Beans between hills 3 weeks later	20.9	33.5	28.6	6.9	22.5
Corn 24" Beans in alternate rows	12.9	24.1	18.8	6.9	16.0
Corn alone 24" in the drill	21.1	34.9	28.4	12.4	24.2
Yield of Threshed Soybeans					
Corn 24" Beans between hills at planting	3.32	(1)	14.16	4.02	7.17
Corn 24" Beans between hills 3 weeks later	Failure	Failure	10.02	4.08	4.70
Corn 24" Beans in alternate rows	5.40	(1)	8.35	4.03	5.93
Corn 12" Beans in alternate rows	3.85	(1)	8.80	6.17	6.27
Total Yield of Grain—Both Corn and Soybeans					
Corn alone 24" in the drill	21.10	.....	28.40	12.40	24.20
Corn 24" Beans between hills at planting	21.32	.....	37.66	9.72	24.87
Corn 24" Beans between hills 3 weeks later	20.9	.....	38.62	10.98	27.20
Corn 24" Beans in alternate rows	18.30	.....	27.15	8.73	21.03
Corn 12" Beans in alternate rows	18.90	.....	27.60	13.07	22.27
Corn alone 24" in the drill	21.10	.....	28.40	12.40	24.20

(1) A good crop of Mammoth Yellow Soybeans was produced but a few wet days followed by hot sun at harvest caused them all to pop out. Otootans were used in 1923 and 1924.

When corn and beans are both drilled in the same row the duplex hopper, which plants beans from one side and corn from the other, is a most economical and satisfactory means of doing the planting. Plates may be obtained for duplex hoppers of the various types of planters, which will either drop beans and corn in alternate hills, in the same hills, drop the corn in hills and drill the beans continuously, or drill both corn and beans. Plates which drop 3 to 4 grains of corn every 24 inches with 6 to 8 beans midway between seem most satisfactory, everything considered. Dropping the corn in hills and thinning to one plant facilitates uniform thinning with a minimum of labor and labor supervision. This also facilitates hoeing the corn without destroying the beans. This is, of itself, a very important factor. Those who expect to produce corn and beans together without hoeing or thinning should plant beans all along and one or two grains of corn every 24 inches on average land. Figure IV shows corn and beans planted with a duplex hopper. The corn has been thinned to one plant.

If a duplex hopper is not available the two may be planted together by mixing the corn and beans and planting through an ordinary corn hopper. A plate having larger holes than for corn alone should be used. A somewhat more nearly regular stand of corn and beans can be obtained by running two planters (one behind the other) and planting the corn with one and beans with the other. Either of these methods plants the beans and corn together rather than in separate hills. The former does not give uniform stands. The latter involves two operations and is rather expensive. The use of duplex hoppers is the economical and satisfactory way but by no means the only way to plant corn and beans together. Figure V shows a satisfactory yield of Cocke Prolific Corn and Laredo soybeans.

If corn is planted in checks—and most Delta corn should be so planted—with a regular check-row planter, or by hand, beans and corn should both be planted in every hill. There are check row planters made which have duplex hoppers and handle both corn and beans regularly. If the planter used does not have duplex hoppers, reasonable results may be obtained by mixing the corn and beans and planting together through ordinary hoppers.

If beans grown in corn must be utilized for hay, planting corn and beans in alternate rows is probably the best practice, unless plenty of hay-barn space is available. The rows should be three feet apart. The corn should be left 12 inches apart on good land and 18 inches on the thinner soils. Nitrate of Soda should be applied to the corn rows only. The bean rows should be planted so as to have a thick stand. The plants should stand as thick in these as where beans are planted alone in rows for hay.

Fig. 5: Cocke Prolific Corn and Laredo Soybeans planted with a duplex hopper April 12, 1924. Photographed August 20th.

TABLE III.—RESIDUAL EFFECT OF OTOOTAN SOYBEANS PLANTED IN CORN

Combination in 1923	Lbs. Seed Cotton Per Acre 1924			
	Actual Yield	Corrected Yield		Per Cent Increase
		Total	Increase	
Corn 24" in Drill Alone	1533.6	1500.2	.....	.....
Corn 24" and Otootans Between Hills at Planting	2186.8	2158.0	657.8	43.8
Corn 24" and Otootans Between Hills 3 Weeks After Planting	2227.3	2217.5	717.3	47.8
Corn 24" and Otootans in Alternate Rows	2326.1	2336.5	836.3	55.7
Corn 12" and Otootans in Alternate Rows	2187.6	2217.3	717.1	47.8
Corn 24" in Drill Alone	1466.7	1500.2	.....	.....
Average Increases	.....	.....	732.2	48.8

The purpose for which the beans are planted, the date the corn is planted, the variety of corn planted and the character of the soil all enter into the determination of what variety should be used.

If the beans are intended for pasture or hay more than one variety should be used. A portion of the area planted to Yellow Dent, Silvermine, or some other early variety of corn and Virginia Beans will furnish some early corn for grain and some early beans for fall pasture. This should be followed by a small area of Paymaster, or some other similar corn and Laredo, or Mammoth Yellow Beans. The main acreage should then be planted to Mosby, Cocke, or other high producing prolific corn and Otootan or Biloxi beans. There are two serious objections to Mammoth Yellows. They germinate poorly under many conditions and they pop out very badly after maturity.

If increased soil fertility is the aim, there are none better than Otootan and Biloxi. The former is considerably safer from the standpoint of obtaining stands. Table III shows an increase in cotton production of 732 pounds of seed cotton per acre in 1924, due to a heavy crop of Otootans in corn in 1923. This cotton at ten cents was worth $73.20 per acre. The increase will not be so great every year, but it is well worth considering. Figure VI shows the cotton produced on the plots which had soybeans the year before and on those which grew corn alone.

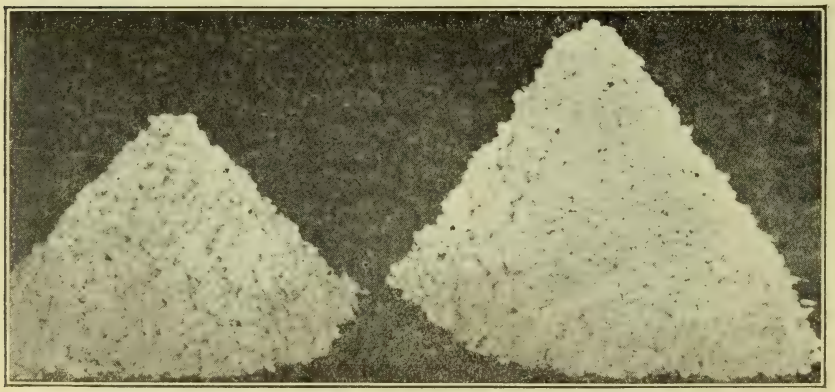

Fig. 6. Left, cotton grown in 1924 after corn alone in 1923 produced 1500.2 pounds per acre. Right, cotton on adacent plots following corn and soybeans produced 2232.4 pounds per acre or 732.2 pounds per acre more. An increase of 48.8 per cent in the cotton yield the following year is some encouragement to plant soybeans in the corn.

On areas infested with coco or other bad, low-growing grasses, Otootan is the best variety now available because of its ability to produce maximum shade in a minimum of time. Laredos rank next to Otootans in ability to produce shade. It is important on infested land to plant plenty of beans and to plant both corn and beans as early as is safe on a well prepared seed bed.

The viny varieties—Otootan and Laredo—planted in corn assist materially in preventing the growth of grass in the corn row early in the season. If the corn is kept clean until the beans are knee high, they will usually furnish sufficient shade to prevent the middles from growing up in grass and weeds. This facilitates working the following crop.

Rate of Seeding: The rate of seeding depends upon the variety and the method of seeding. There is very little experimental evidence to indicate what the proper rate of seeding is. Observations of the writer indicate that the rates recommended for the various varieties in Table V are approximately correct. Rates of seeding test failed in 1924 for lack of moisture to germinate the seed. Rates of seeding four varieties—Virginia, Laredo, Biloxi and Otootan—are being tested in 1925. Laredos are planted at the rate of 6, 9, 12, 15, and 18 pounds per acre in 3 foot rows. The other varieties were planted so as to have the same number of plants per acre as the Laredos at the above rates. This test will be continued until definite conclusions as to the proper rates of seeding are possible.

Cultivation: There is very little definite data regarding methods and amounts of cultivation which are most economical in the production of a crop of soybeans. Five years observation indicates that enough cultivation to keep down the weeds is all that will pay. Beans planted in rows on the Station have been cultivated the same as cotton but only half as often. Three cultivations are usually sufficient and two will do on clean land. On bad coco lands more cultivation is necessary for best results. With perfect stands no hoeing is necessary even on coco lands. On lands infested with burrs or Johnson Grass it is necessary to chop these weeds out one time. This should be done when the beans are about 10 to 12 inches high. If they are cleaned out at this size, weeds and grass have little chance of getting another start.

VARIETIES

Soybean varieties are very numerous and very diverse in their habits of growth, dates of maturity, yield, size of seed, color of seed and many other characteristics. The majority of varieties grow erect, but are branched with a well defined main stem or trunk, but some of the most valuable are very viny and tangle very badly. Soybean leaves are made up of three leaflets. There is great variation in the

color, size, and shape of the leaves of the various varieties. So insensibly do these leaf characters merge that they are useless in varietal differentiation, except in very rare cases. In this section the size of the leaflet varies from ¾ inches wide by 1⅝ inches long to 2 inches wide and 4½ inches long. The color is one of the various shades of green.

Flower Color: All varieties tested so far at the Delta Station have either white or purple flowers. Some varieties can be distinguished by the color of the flowers, but many varieties have flowers of both colors. The plants of the same variety often seem to vary in no other important character than flower color.

Pods: Varieties vary greatly in the size of the pods. Most pods are flat, or nearly so, and are between 1½ and 2½ inches long. The pods of a few varieties are nearly cylindrical. Some are less than 1½ inches long and some may have pods 3½ inches long. There are usually from 3 to 6 pods to the cluster at each node or joint.

Most varieties shatter rather badly if handled when dry. Several varieties pop out very promptly after maturity and are therefore lost to harvesting, unless gathered at the right time. Biloxi pops out very little if any, and shatters very little unless cut when thoroughly mature and handled when very dry. Otootan pops out very little and does not shatter badly. Laredo pops out and shatters much less than Mammoth Yellow, but more than the above varieties. Many Laredo selections are being tested in the hope that a strain may be found which pops and shatters little and has the other desirable characteristics of the parent variety.

Size, Shape and Color of Seed: The various varieties vary greatly in size. The largest seeded varieties sometimes run as low as 60,000 seed per bushel, while those having the smallest seed may have more than 700,000 seed per bushel of 60 pounds. The size of the seed varies much within the variety. Seed grown under favorable soil and moisture conditions are much larger than those of the same variety grown under adverse conditions.

The shape of the seed varies with the varieties from almost a sphere, in some varieties, to seed which are very thin and flat and elliptical in shape in other varieties. Figure VII shows the shape and relative size of the seed of 18 varieties. Table IV gives descriptive data on 51 varieties.

The color of the seed is variable. Yellow, black, brown and green are the common colors. Varieties with yellow seed are most numerous, but several of the most important varieties for this section are black and some are brown. One or two green seeded varieties look promising.

TABLE IV. DATA ON 51 VARIETIES OF SOYBEANS

Variety	Earliness Days to		Character of Variety				Introduced From
	Mature	Flower	Plant Type	Seed color	Seed Per Bushel	Percent Oil	
A. K.	110	53	Erect	Yellow	159,000	19.2	Manchuria 1912
Aksarben	110	43	Erect	Yellow	161,000	19.0	Manchuria 1913
Aksarben	110	43	Erect	Yellow	161,000	19.2	Manchuria 1913
Barchet	160	83	Viny	Brown	645,000	13.3	China 1908
Biloxi	165	88	Erect	Chocolate	112,000	20.1	China 1908
Black Beauty	Same as Ebony						
Black Eyebrow	110	38	Erect	Brown	148,000	19.9	Manchuria 1911
Chestnut	105	43	Erect	Russet	195,800	18.3	U. S. D. A. 1907
Chiquita	135	68	Semi-Viny	Yellow	242,000	17.6	China 1910
Columbia	125	53	Erect	Green	200,000	18.7	China 1908
Early Brown	110	43	Erect	Brown	182,400	17.7	Ito San E. Black
Easycook	125	53	Erect	Yellow	162,200	19.3	China
Ebony	120	48	Erect	Black	194,400	18.4	Korea 1900
Elton	110	38	Erect	Yellow	130,000	17.4	Siberia 1906
Guelph	115	48	Erect	Green	149,000	19.5	Japan 1889
Hoosier	115	38	Erect	Yellow	150,700	19.3	Manchuria 1911
Haberlandt	125	53	Erect	Yellow	144,000	19.4	Korea 1901
Hamilton	125	53	Erect	Auburn	123,800	19.2	Ohio Station
Habaro	110	40	Erect	Yellow	188,200	19.6	Siberia 1906
Hahto	130	58	Erect	Yellow	74,800	17.9	Japan 1915
Hollybrook	135	63	Erect	Yellow	157,400	18.2	T. W. Wood 1902
Ito San	105	43	Erect	Yellow	198,900	16.9	Japan 1890
Laredo	140	78	Viny	Black	466,500	14.0	China 1914
Lexington	125	53	Erect	Yellow	215,000	19.1	U. S. D. A. 1907
Mammoth	145	88	Erect	Yellow	128,700	18.6	Origin Unknown
Mammoth Brown	135	68	Erect	Russet	111,300	16.5	Origin Unknown
Manchu	115	38	Erect	Yellow	141,000	18.9	Manchuria 1913
Mandarin	100	38	Erect	Yellow	174,700	19.8	Manchuria 1911
Med. E. Green	Same as Guelph						
Med. E. Yellow	Same as Ito San						
Med. Green	Same as Guelph						
Med. Yellow	Same as Midwest						
Merko	120	43	Erect	Olive	294,600	16.4	Siberia 1906
Minnsoy	100	38	Semi-Viny	Yellow	221,700	16.3	Minn. Station
Midwest	115	48	Erect	Yellow	243,000	15.0	China 1901
Mikado	120	48	Erect	Yellow	185,200	18.2	Mongol Sel. 1905
Mongol	Same as Midwest						
Morse	130	58	Erect	Yellow	149,700	18.1	Manchuria 1906
Ogemaw	85	33	Erect	Chocolate	188,000	17.5	Blk. & Dwf. Brown
Ototan	170	98	Viny	Black	368,600	17.7	Hawaii 1911
Peking	120	53	Erect	Black	383,300	16.00	China 1907
Pinpu	105	38	Erect	Yellow	160,300	18.4	Manchuria 1910
Sable	Same as Peking						
Tar Heel Black	140	78	Erect	Black	163,200	18.6	China 1905
Tokio	145	74	Erect	Yellow	134,400	18.4	Japan 1901
Virginia	125	53	Semi-Viny	Olive	207,300	17.9	Morse Selection
Wilson 5	120	53	Viny	Black	301,400	15.2	Wilson Sel. 1912
Wilson	120	53	Viny	Black	301,400	18.4	Manchuria 1906
Wis. Black	100	45	Erect	Black	185,200	17.7	Wis. Station
Wea	110	38	Erect	Yellow	194,900	19.6	Manchuria 1911
Yokotenn	120	53	Erect	Yellow	170,000	19.9	Japan 1907

The data in this table are compiled from Station publications, books, and other reliable sources.

Earliness: Varieties vary greatly in the time required to mature Table IV shows that Ogemaw only requires 85 days to mature, while Otootan requires 170 days, or just twice as much time. The date of planting has much to do with the length of time required to mature. Otootans planted March 20th mature only 5 to 10 days earlier than the same variety planted June 15th. This lengthening of the period of growth is not so great with earlier varieties. Experiments at the Delta Station with four important varieties indicate that the first 3 or 4 plantings, which usually extend over a period of 30 to 45 days, are harvested together in normal years.

The spring of 1925 was abnormally dry. Soybeans did not behave ordinarily. Laredos which germinated about March 12th to 15th had many mature beans on them by June 25th. In other years Laredos, the same age, have not begun to bloom until the last of July or the first of August. Virginias planted from March 20 to April 1, 1925 were ready to cut for hay by July 1st. Ordinarily, they would not have been so far matured before August 15th. The dry hot weather seemed to speed up maturity in the soybeans the same as in cotton. Much of the early planted cotton was as far advanced July 1st as it would have been in normal years August 10th.

VARIETIES DESCRIBED: With soybeans as with other feed crops, yield of grain and forage is the most important factor in the selection of varieties. Earliness, habit of growth, shattering, popping out, character of forage produced, retention of leaves, etc., must also be considered. Table V shows hay yields of the varieties tested for hay. In Table VI grain yields are given for those tested for grain. Many other varieties are being tested in 1925 and it is hoped that high producing, early varieties adapted to this section will be found. The descriptions given below apply to Delta growth.

Barchet: A very tiny variety intermediate between Laredo and Otootan in its habit of growth; very late—usually matures only a few days before frost, regardless of the planting date; flowers purple; seed brown, oblong, and very small; 16.62 pounds equal 60 pounds of Mammoth in number of seed. The seed germinate well. A good variety for hay and soil improvement. It may be planted interchangeably with Otootan when seed are available.

Biloxi: An upright grower very similar to Mammoth, except that it grows taller and produces more hay and grain than Mammoth. Unless planted very thick, the stems are large and woody. The flowers are purple and the seed dark brown and large. 57.96 pounds of Biloxi equals 60 pounds of Mammoth in number of beans. Biloxi is a late variety, usually maturing about ten days or two weeks before frost. It is a heavy grain yielder and is well adapted to hogging or pasturing with other livestock. The beans do not pop out in the field and shatter very little in handling. It is excellent for planting in

corn, for pasturing, and is a good hay producer. The hay is rather stemmy and is not so well cleaned up by livestock as that produced from Laredo, Otootan, and other viny varieties. Since the seed are large it is not as easy to obtain a stand under unfavorable conditions as with the small seeded sorts. Everything considered, it is an excellent variety. Its high oil content makes it very desirable for crushing.

Ebony: There seem to be two black seeded varieties on the market as Ebony. The one here intended has seed which are very small and almost spherical (very similar to, and easily mistaken for, Otootan). The habit of growth is semi-viny, similar in many respects to Virginia. This variety has never been grown at the Delta Station, except for observation. The small size of the seed makes it inexpensive to plant. Maryland and Alabama have both found it a good early variety. It should not be expected to yield as well as the late varieties.

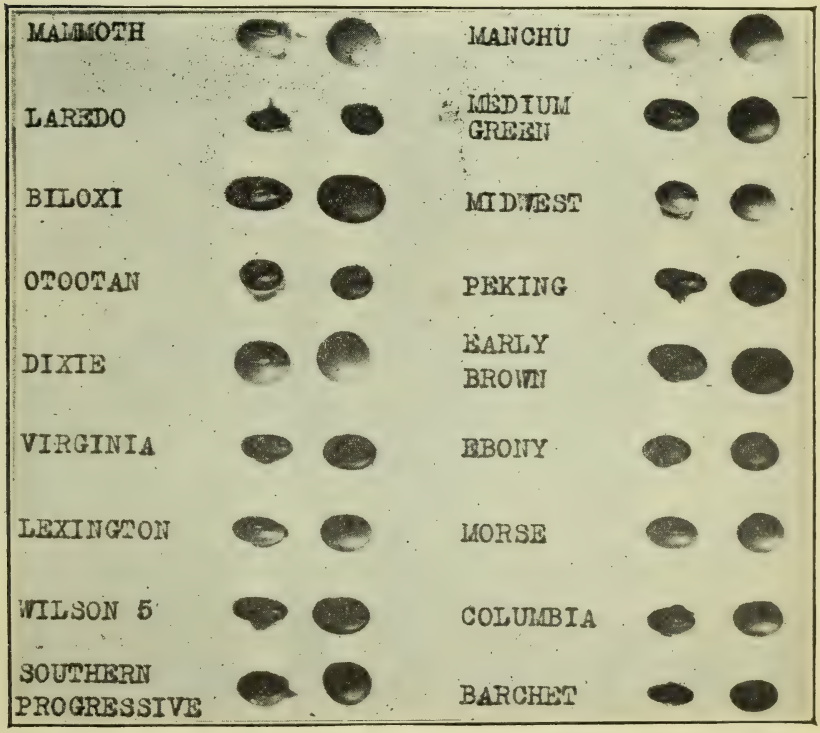

Fig. 7: Seed of 18 varieties of soybeans. Note shape and size.

TABLE V YIELDS OF VARIOUS HAY CROPS

Crop and Variety	Pounds of Air Dry Hay Per Acre		
	1922	1923	Average
VARIOUS CROPS COMPARED—FLAT BUCKSHOT SOIL			
Mammoth Soybeans	3,300	1,010	2,155
Whippoorwill Peas	*	*	*
Mung Beans	2,730	2,030	2,375
Early Speckled Velvet Beans	*	560	280
Japanese Sorghum	12,780	5,580	9,180
VARIETIES OF SOYBEANS—FLAT BUCKSHOT SOIL			
Wilson	4,100	2,620	3,360
Virginia	5,320	3,500	4,410
Laredo	5,360	2,960	4,160
Mammoth	7,610	1,440	4,525
Barchet	5,250	.....	.....
Biloxi	7,360	3,120	5,240
Otootan	7,280	4,170	5,725
VARIETIES OF COWPEAS—LOAM SOIL			
Whippoorwill	3,560	1,300	2,430
New Era	3,460	1,490	2,475
Brabham	3,220	1,860	2,540
Groit	2,960	1,350	2,150
Victor	3,440	.....	.....
Clay	3,060	1,580	2,320
Unknown	3,940	1,720	2,830

*Failure

TABLE VI SOYBEAN VARIETY TEST FOR SEED 1923-24

Variety	Bushels per Acre			Pounds Required to Seed an Acre			Rank in Earliness
	1923	1924	Average	Broadcast (1)	In Drills (1)	In Corn	
Peking	10.11	6.50	8.31	74.10	18.53	12.35	2
Virginia	9.70	11.93	10.82	78.05	19.51	13.01	3
Mammoth—01	20.92	13.51	17.22	150.00	37.50	25.00	10
Mammoth	21.31	11.64	16.48	150.00	37.50	25.00	11
No. 37254 U. S. D. A.	11.52	12.91	12.22	111.80	27.95	18.63	7
No. 44210 U. S. D. A.	7.94	14.55	11.25	128.90	32.23	21.48	5
No. 37261 U. S. D. A.	8.72	7.72	8.22	128.90	32.23	21.48	6
No. 46687 U. S. D. A.	5.41	11.40	8.41	144.90	36.23	24.15	4
No. 37396 U. S. D. A.	12.81	10.94	11.88	144.90	36.23	24.15	8
Biloxi	33.42	13.84	23.63	144.90	36.23	24.15	12
Otootan	22.79	7.51	15.15	64.95	16.24	10.83	13
Laredo	12.01	10.43	11.22	42.05	10.51	7.01	9
Wilson	7.96	9.06	8.51	66.10	16.53	11.02	1

(1) On areas heavily infested with bad grass these rates should be increased 50 per cent.

Laredo: This variety was introduced from China in 1914. Under favorable conditions it is strictly a viny variety. In dry seasons, on poor soil, it is slender and erect. The habit of growth is shown in Figures 5, 8, and 10. In this section it matures 10 days or two weeks earlier than Mammoth Yellow, usually maturing in 135 to 145 days. The seed are very small, flat, black, and oblong. 16.82 pounds of Laredo equals 60 pounds of Mammoth in number of beans. The flowers of some plants are white while other plants have purple flowers.

The increase in popularity and acreage enjoyed by Laredo Soybeans has been phenomenal. A small sample was obtained from W. J. Morse, of the Bureau of Plant Industry, U. S. Department of Agriculture in the spring of 1921. These were planted in rows on bad buckshot land on the Station farm along with 20 other varieties. The yield was 35 bushels per acre. Many of the other varieties produced less than 10 bushels under identical conditions. In the spring of 1922, two acres of flat, coco infested, buckshot land was planted to Laredos in rows. This produced an enormous tonnage of forage and 25 bushels of beans per acre. A volunteer crop on the same area in 1923 produced 26 bushels per acre. It is a good seed producer.

Laredo is one of the Delta's most popular hay varieties. It produces an average yield of high quality hay. The stems are fine and the percent of grain high. It is early enough to be harvested in warm weather—usually the latter part of September—and late enough to be productive. For planting in corn on coco land, it ranks next to Otootan. If the beans in the corn must be cut for hay the corn and Laredos should be planted before April 20th, or the beans may ripen ahead of the prolific varieties of corn.

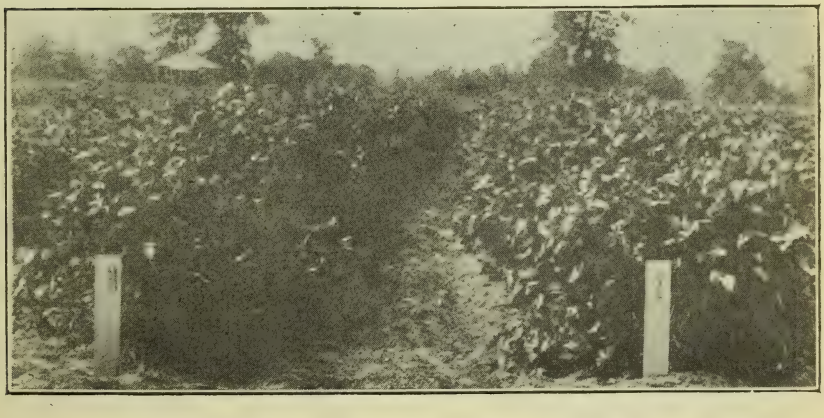

Fig. 8: Left, Laredo; Right, Otootan. Note relative growth.

Laredo germinates better, under unfavorable conditions, than any other variety tested. Perfect stands have been obtained when Biloxi failed to germinate and Otootan produced slightly broken stands under identical conditions. It is an excellent variety for the Delta. Seed should be bought from reliable dealers. Arlington, Peking, and Wilson may be mistaken for Laredo.

Lexington: A bushy, medium early, (about as early as Virginia), greenish yellow seeded, small seeded variety. A very popular variety in the north central south. It has only been grown in the observation test at the Delta Station. 32.0 pounds of seed will plant as far as 60 pounds of Mammoth.

Mammoth Yellow: This is the old standard variety in the South. Until recent years, the terms Mammoth and soybeans were synonyms in the mind of the average southern farmer, because it was the only soybean grown generally. The plants are erect and the period of maturity 140 to 150 days. Figure IX shows the habit of growth when planted in wide rows. Planted in narrow rows, fewer lateral branches are produced and the plants are more nearly erect. The seed are large, there being only 2,473 per pound against 8,826 of Laredos and 8,930 Barchets per pound. The flowers are white. Mammoth is a good producer of both hay and grain. The hay is rather stemmy, unless the stand is very thick. When planted for grain, it is essential that harvesting be done in time. If allowed to become slightly over ripe,

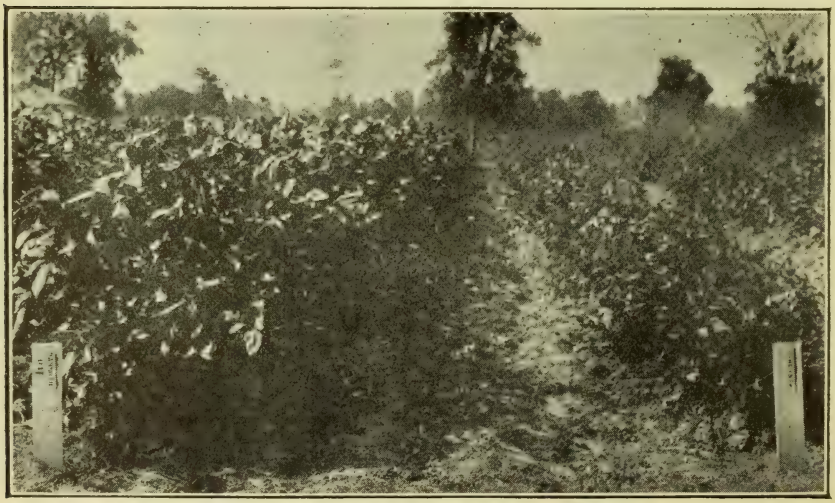

Fig. 9: Left, Mammoth; right, Virginia. Note relative growth.

the pods will all pop open and the beans be lost. This habit probably accounts for frequent failures to obtain stands with this variety. Much seed is harvested before mature. If such seed is not properly stored it heats and loses its vitality. Bad stands result. All large seeded varieties break their necks "more or less" in getting out of the ground, if conditions are unfavorable. Good stands of Mammoth can be obtained, however, if the seed are sound, good seed beds are prepared, the seed are planted 1½ inches deep or less, and weather conditions are favorable.

Morse: Very similar in most respects to Lexington. It is 5 to 10 days later than Lexington and the seed are a little larger.

Otootan: This variety was introduced by C. E. McClelland from Hawaii in 1911. For some reason its many good qualities were not quickly detected. It was planted first at the Delta Station in 1921. From the beginning, it looked promising for hay and to plant in corn. The frontispiece and Figure VIII show its habit or growth at the Delta Station. Otootan is strictly a viny variety under average Delta conditions. Planted late on poor soil in an extremely dry season, the plants produced are slender and erect. In number of seed, 21.2 pounds is equivalent to 60 pounds of Mammoth. The seed are black and nearly spherical. The seed of Black Beauty, Ebony, and Cloud are easily mistaken for Otootan. Those unfamiliar with the size and shape of the seed may mistake Peking, Wilson, and Arlington for Otootan. Seed should be purchased from reputable dealers.

With normal weather in the Delta, Otootan matures just before frost, if planted between March 15th and June 15th. An abnormally early frost may catch any Otootan crop before maturity. The early plantings produce very heavy crops of hay of good quality. The trouble with Otootan for hay is its late maturity. Just before frost the days are cool and short, making it hard to cure dense growths of hay crops. If cut earlier, less grain is obtained, the hay yield is smaller, and that produced has a lower feeding value. Later plantings produce higher percentages of grain but less hay. Otootan shatters and pops out very little.

To plant in corn, there is no better variety than Otootan. It makes rapid growth and chokes out weeds and grass in the row early in the season. Its habit of running over the entire row and middle and staying green until frost makes it ideal to plant in corn, or alone, on areas infested with coco or other bad low-growing grasses.

Stands are easily obtained with Otootan. When conditions are extremely unfavorable Laredo germinates better than Otootan. Laredo volunteers much more readily than Otootan, but fair stands of volunteer Otootans have been obtained. Otootan is one of the best varieties to

plant in oats in late March or early April. It is a little more vigorous grower than Laredo and is better able to compete with any weeds that may be left over after the oats are cut.

Peking: An early, semi-viny, small seeded, black seeded variety which offers some promise for extremely early hay. The seed are easily mistaken for Laredo, although they are larger and not nearly so flat. In number of beans, 29.64 pounds is equivalent to 60 pounds of Mammoth.

Virginia: An early, high producing, semi-viny variety. The seed are brown, small—31.21 pounds equals 60 pounds of Mammoth in number of beans—oblong, germinate well. The flowers are purple. The plants grow upright to a height of 30 to 40 inches, after which the ends of the branches and the main stems twine. Figure IX shows the relative growth of Mammoth and Virginia in wide rows.

Virginia produces a good yield of hay of good quality. Planted between March 25th and June 1st, the hay will be ready to harvest between July 25th and August 15th, in normal seasons. This period is very satisfactory on cotton plantations for harvesting at least a part of the hay crop, since it does not compete with cotton picking for labor. Virginia is becoming a popular hay variety. In addition to the above good qualities, the seed are cheap and abundant.

Wilson: Under normal Delta conditions, Wilson is a viny variety similar in character of growth to Laredo. It is very early and produces much less hay than Laredo or Virginia. It matures hay 10 to 15 days earlier than Virginia. The seed are small, 26.43 pounds being equal in number to 60 pounds of Mammoth, black, slightly flattened, oblong and are quite easily mistaken for Laredo. This variety has no place in this section except for extremely early hay or as a catch crop to plant very late. With favorable seasons, Peking and Wilson will make hay planted as late as July 20th.

Fig. 10: Laredos broadcasted May 10th. Photographed September 1, 1924.

USES OF SOYBEANS

The uses of soybeans are many. Probably no other common Southern field crop can be profitably used in so many various ways. In the Orient it is grown primarily for its seed but not so in the United States and especially in the South. From 16 to 25% of the American acreage is harvested for seed and the balance used for other purposes. In the Delta probably less than 10% of the acreage, on the average, is harvested for seed.

Plowing down soybean fields as green manure will pay well but not so well, perhaps as letting the crop mature and feeding as hay. pasturage, silage, or as a soiling crop (cutting and feeding green).

SOYBEANS FOR HAY: As a Delta hay crop the soybean is hardly excelled, if equalled. Yields are very satisfactory and the feeding value high. The protein content is high because of the nature of the plant and high proportion of grain produced. Delta farmers can grow no other hay, economically, which is so nearly "both corn and fodder" as the soybean produces. Feeding tests indicate that Alfalfa hay is not equal in feeding value to soybean hay. This is especially true when the beans produce an average grain crop.

Idle work mules or horses can be kept in good condition on soybean hay alone. Work animals should receive ¾ to 1¼ pounds of corn per day for each 100 pounds of live weight in addition to the hay. But it is possible to maintain animals doing light work on good soybean hay alone.

Harvesting and Curing Soybean Hay: Soybeans should be cut for hay as soon as the top pods are well formed. Cut at this stage few leaves will be lost and the beans are at their best regarding palatability, and the quantity of total digestible nutrients contained in the hay. If cut earlier the yield is less and the plants more watery and harder to cure. If cut later more leaves will be lost in handling and the stems become woody and less palatable and digestible.

The length of the possible harvest period is much greater than with cowpeas. Soybeans may be cut much earlier or left uncut much later than indicated above and still produce hay of fair quality. This enables soybean hay producers to extend the harvest period to avoid bad weather and to care of shortages of labor.

Due to less moisture in the green plants soybean hay is much easier cured than cowpeas. It should be cut after the dew is off and let lie in the swath until thoroughly wilted when it should be raked into windrows. Leave in the windrows 12 to 24 hours and make into high narrow cocks. A better quality of hay is obtained if most of the curing is done in the cock. Well made cocks will stand much wet weather with little damage. If hay loaders are to be used the wind-

rows may be made large by rolling two or three small ones together with a side delivery rake and letting the hay cure in the windrows. Much less labor is required and cheaper hay is obtained. If labor is expensive, it is doubtful if the increase in quality will justify the expense of cocking. The hay should not be stacked or housed until it is absolutely well cured.

Very heavy growths of Laredo, Otootan, and other viny varieties often are very troublesome to cut, due to the practical impossibility of preventing the cut vines of each swath from choking the blade when the next swath is being cut. This is especially true when the seed are permitted to mature and many, if not most, of the leaves have fallen. This trouble can be prevented by having a side delivery rake follow the mower and move the cut swath out of the way.

Yields of Soybean Hay: Table V shows the yields of various crops in 1922 and 1923. These crops were planted after oats each year. Because of dry weather all crops planted after oats at the Delta Station in 1924 failed. On flat buckshot soil Japanese sorghum has averaged 9,180 pounds per acre; Mung Beans, 2,375; Mammoth soybeans, 2,125 pounds; and Early Speckled Velvet Beans only 280 pounds per acre. Whippoorwill Peas failed both years. This type of soil will not grow peas profitably. Unfortunately, Otootan and Laredo Soybeans were not used in this test. But the soybean variety tests were conducted on land very similar and the treatment was in every way identical. In

Fig. 11: A good stand of broadcast Otootans. The hat is on the ground.

the latter test Otootan soybeans averaged 5,725 pounds of hay per acre. The latter hay contained at least 15 bushels of grain. This makes the Otootan soybean compare favorably with sorghum hay, and the effect on the soil is all in favor of the soybeans. The variety test of cowpeas has been conducted on well drained loam soil. For this reason the hay yield should be greater than that of soybeans. The reverse is true. The best variety of soybeans has produced 100% more hay than the best variety of peas. In addition to the increase in yield the soybean hay had 5 to 15 bushels of beans on it. There was practically no grain in the pea hay. The leaves were nearly all lost from the peas if they were not cut exactly at the right time. Soybeans held their leaves well. Table V represents only average yields. Figures I and X show fields of Otootans and Laredos which produced 30 to 40% more than the average yields shown in the table.

Most Delta planters are familiar with Laredos, Otootans, and Biloxis as good varieties. Virginia is another varity worth consideration. It is semi-viny, very early, and a good producer of both hay and grain. Farmers who expect to use soybeans exclusively for hay should plant ¼ of the acreage to Virginia, ½ to Laredo, and ¼ to Otootan or Biloxi. The Virginias may be harvested before cotton picking time, the Laredos in September or October, and the others just before frost. This so distributes the harvest seasons as to avoid bad weather on at least a part of the crop. It is very probable that when more data and experience are available the recommendations for Virginia will be strengthened even more. Its earliness is especially desirable and it has considerable ability to produce both hay and grain.

Planters should buy Laredo and Otootan seed from reputable growers or dealers, since there are others which have black seed and may be mistaken for Laredos and Otootans.

THE DELTA SHOULD CERTAINLY RAISE ITS HAY: Soybeans Are Safe for That Purpose.

Soybean Straw as Hay: The straw obtained when soybeans are threshed for seed has much value as a roughage. For wintering dry dairy cattle, beef cattle, and idle mules, it will replace good hay, especially where some grain is used. For sheep and milking dairy cattle it is excellent roughage.

Analyses indicate that it contains 3 times as much digestible matter as corn fodder, or stover, and more than 3 times as much digestible protein as oat and wheat straw. Good soybean straw should be worth half as much as good alfalfa or soybean hay for feeding anything except mules or horses doing hard work. It contains too much indigestible material to be adapted to the latter purpose but may be used.

Soybeans in Corn for Hay: Soybeans should be planted alone for hay but it is often necessary to harvest everything available in order to have enough forage. Soybeans planted in alternate hills with corn usually produce a heavy tonnage. If the corn stalks are large and the beans heavy an ordinary mower cutter bar will not handle them. Most manufacturers provide bush or ditch bank blades for their machines. These handle beans and corn stalks very nicely so far as the cutting is concerned. Where the growth of viny varieties is heavy the same trouble is often experienced as when cutting rank beans alone, but may be avoided in the same way.

Where shredders are available the entire crop of corn stalks and beans may be run through the shredder. The ears are separated from the forage by the shredder. The remainder may either be blown into the barn or baled.

If the whole crop of beans and corn is ground as it comes from the field an excellent product is the result. If this is done extreme care is necessary to see that the mass is dry enough not to damage in storage.

If the mixed crop is not to be ground or shredded the corn should be snapped, before the crop is cut, and stored in the crib. The corn stalks may be thrown out of the hay or hauled in with it. The mixture of stalks and hay fill space very rapidly. Unless an abundance of storage space is available it will be necessary to resort to the baler.

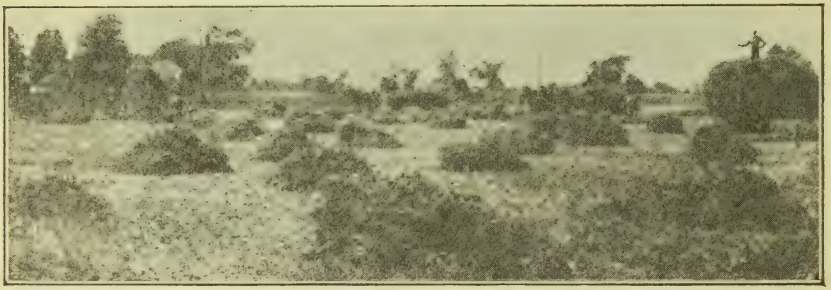

Fig. 12: Laredo Hay from a volunteer crop.

SOYBEANS FOR GRAIN: Growing soybeans for the grain produced is profitable especially on thin soils where the increase of soil fertility, due to the residual effect of the soybeans, is important. The yield of grain will compare favorably with that of corn on much of the buckshot soil in the Delta and the grain is much more valuable. Figure XIII shows soybeans in 3 foot rows for grain.

Fig. 13: Soybeans in 3 foot rows for seed.

Time of Harvesting: The uniform habit of maturing assists materially in harvesting soybeans for grain. Unlike cowpeas, the plants reach definite size, according to variety, date of planting, climatic and other conditions, and then come to full maturity in short order. Before all of the pods are mature most of the leaves yellow and fall off. The best time to harvest, except when field harvesters or threshers are to be used, is when ½ to ¾ of the leaves have fallen and ¾ to 4-5 of the pods have begun to lose, or have lost their green color. Laredos and Otootans should be cut as soon as the beans in the top pods begin to turn pink. If cut much earlier the vines will be harder to cure and much immature grain will result. The latter cannot be separated from the good beans and the quality of the product is materially lowered. If left too long most varieties shatter badly and many pop out to the extent of ⅔ of the yield in a very few days. The stage of maturity at which soybeans should be cut varies with variety, date of maturity, and the condition of the weather at harvest time. If the weather is moist and cool they may be allowed to stand much longer than if the weather is hot and dry. Biloxis and Otootans are both very late and pop out very little. They may be left until fully mature. If the straw is to be used to replace hay for work animals the plants should be cut earlier than indicated above in order to retain more leaves and prevent extreme woodiness in the straw.

If regular soybean harvesters are to be used the plants should be permitted to fully mature.

Methods of Harvesting: The common method in use in this section today is very much the same as the ordinary haying operation, except that the soybeans are permitted to mature as indicated above. Following the mower with the side delivery rake as suggested in the discussion of "Harvesting and Curing Soybean Hay" is usually economical in cutting heavy growths of the viny varieties for seed.

It seems safe to predict that not many years hence soybean harvesters will be evolved which will much more economically harvest seed than is possible through the mower, rake, and thresher route.

Curing and Storing Unthreshed Seed: The curing process is the same as for hay except that the cut vines or plants should be raked into small windrows almost immediately after they are cut to prevent shattering. This is accomplished very satisfactorily when the side delivery rake follows the mower, but if cutting is not facilitated by raking as the cutting is done, the raking may be done a few hours later. The latter practice will waste more beans than the former because both the mower and the mower team will pass over the cut beans in addition to the rake team.

Most of the curing should be done in tall narrow cocks made from 24 to 48 hours after windrowing. The cured seed and straw should be housed if possible. If shed and barn room are not available, threshing from the field is safest and is most economical at any time weather will permit. If this is not practical stacking is the only resort.

The principle to be followed in stacking is the same as for hay and other materials. Long narrow stacks are best. It takes a good man to make stacks which will protect the beans. No stack should be allowed to remain uncovered. Canvasses are expensive but may be used if available. The cheapest roof is made from cheap roll roofing with 1 x 6 boards under the laps to nail to. Wires should be stretched over the top of the paper roof every 4 to 6 feet and weighted at each end to prevent blowing off.

Only common sense and experience can tell a man when the cut material is ready to house or stack. The common error is to haul before it is dry enough but 24 hours in the windrows and 48 hours in the cock is usually sufficient time before hauling in good haying weather. Less time is necessary if left longer in the swath and windrows than recommended above. The stage at which the beans are cut will have much to do with the time required to properly cure them.

Threshing: Threshing the viny varieties from field, barn, or stack is slow, difficult, and expensive regardless of the machine used. Seventy-five bushels per day is much above the average with any type of threshing machine used in this section. Any ordinary grain separator can be adjusted to thresh beans. To prevent cracking the beans it is necessary to change pulleys so as to reduce the cylinder speed at least half and maintain the regular speed on all other parts of the machine.

It is usually necessary to remove ½ to ¾ of the concaves or to use thin concaves. Special bean attachments can be bought for most grain threshers. These are said to be satisfactory and economical. Special machines are built which do satisfactory work. If not more than an acre or two are grown, it is probably more economical to beat them out than to rearrange and set up a thresher.

Soybean Harvesters: There are four or five patented machines which thresh the beans from the fully matured standing plants. Most of these are made to harvest from rows and are best adapted to bush varieties. Figure XIV shows the most common type. Such a machine works perfectly on bush varieties planted in rows from 32 to 42 inches wide. It is not perfectly adapted to viny varieties but does a good job even on Otootans and Laredos if the growth is not exceedingly rank.

The machines are simply small threshers on wheels. Most of them have only the cylinder, though some have straw elevators and one or two are equipped with cleaners. The machine illustrated in Figure XIV is drawn by two mules and operated by a driver and a man to throw the straw out of the box. In rank viny varieties it is desirable to have two teams, so they can be alternated, or to use four mules. It usually pays to make two trips per row on the viny varieties, if they are large and have lodged to any extent. The second trip should be made in the opposite direction to the first. Two men with one of these machines can harvest from 2 to 6 acres per day depending upon conditions.

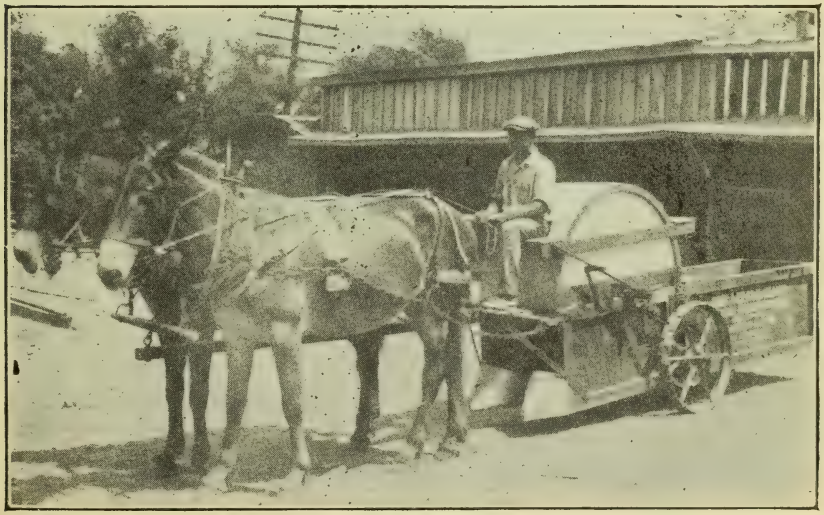

Fig. 14: The row type of harvester is used extensively in the southeast.

The loss of beans is as small, if not smaller, with machines of this type than the loss in handling when the beans are cut with a mower and threshed. The use of the harvester is very much more economical for all areas which it will handle. The use of harvesters is facilitated by growing 2 or 3 varieties having different dates of maturity so as to lengthen the harvest period.

The machine shown in Figure XV is intended for broadcast beans. The principle of this machine can be made to do the work whether it is perfected now or not. The broadcast principle will facilitate means of raising viny varieties within reach of the cylinder or beater. This is probably the weakest point in the construction of the row machines. There is little doubt but that perfectly working machines for both row and broadcast seeding will be available at reasonable prices within a few years. The principle is too valuable not to be worked out. The broadcast machine shown in Figure XV is made for tractor power. The tractor is driven on the harvested area, thus preventing loss from shattering which occurs when the power unit must move over unharvested beans. It is equipped with screens and bagging apparatus.

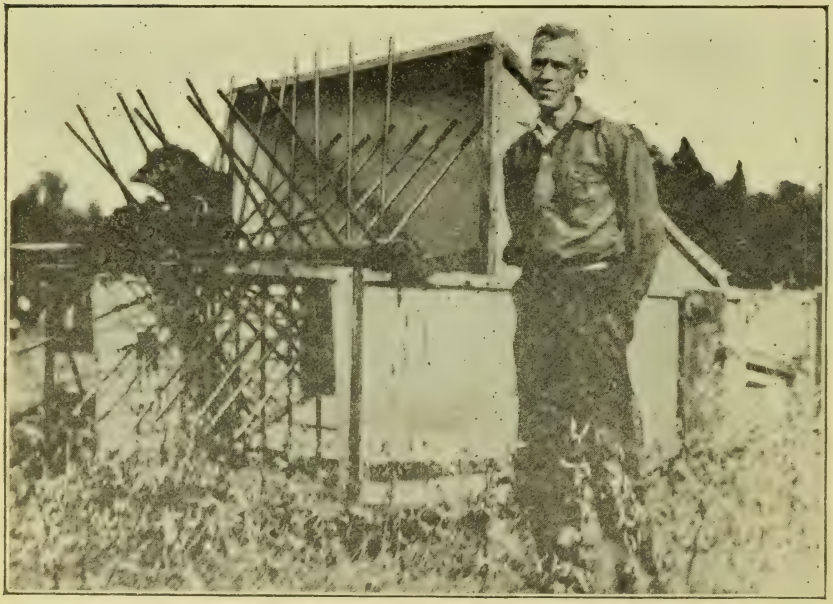

Fig. 15: The broadcast harvester promises much for the future.

Other Methods: Side delivery attachments for mowers are sometimes used to rake the cut beans into small piles and out of the way of the team and wheels when the next swath is cut. This will not work satisfactorily where viny varieties are used and heavy yields are obtained. The self rake reaper is often used but has the same shortcomings as the side delivery mower. Upright varieties may be cut with a grain binder and shocked as oats or wheat. All these methods require the threshing operation after the beans are cured. The grain combine handles the upright varieties very successfully.

Cleaning: Regardless of the method of harvesting and threshing most seed must be recleaned before being marketed. This operation is rather simple and inexpensive. Any substantial cleaner equipped with proper screens and a good fan will do the job. An ordinary fanning mill will remove most of the stems, leaves, and other trash but short pieces of stems have to be screened out.

In the Delta the removal of small particles of buck shot soil is vey difficult. There seems to be no economical way of removing the particles which go through the same screen as the beans. Beans which are to be sold for feed need not have this soil removed. It will go through seeders with the beans and furnish inoculation for areas which have never grown beans before. It is necessary, however, to determine the percentage of soil the beans contain in order to figure values properly.

Storing Seed: Unless the beans are perfectly dry when housed they should be spread on a floor and shoveled daily until fully dry. Deep and poorly ventilated bins should be avoided. The germination of the seed is ruined easily by heating. This accounts for many of the poor stands of the large seeded varieties in the past. The dry beans should be bagged and the bags stacked with air spaces between for ventilation. Weevils seldom attack soybeans and rats do not eat them as readily as they do other grain.

SOYBEANS FOR SOIL IMPROVEMENT: Few crops offer so much to the Delta for soil improvement as soybeans either plowed under, or grazed and the residue plowed under. Every ton of dry hay or residue turned under adds approximately 50 pounds of nitrogen to the soil. The roots which produce the hay add approximately the same amount of nitrogen to the soil. Roughly speaking, soybeans add 100 pounds of nitrogen to the soil for every ton of hay produced, provided, of course, they are grazed or turned under. Theoretically, a two ton crop of soybeans so used is worth more than 1,000 pounds of nitrate of soda.

Table III shows the residual effect of soybeans planted in corn in 1923 on the 1924 cotton crop. The soybeans made an excellent growth and were grazed by hogs and cattle. Since this only represents one year, nothing but the average of all should be taken seriously. But an average increase in the succeeding cotton crop of 48.8% or 732 pounds of seed cotton worth $73.20 per acre is very well worth considering seriously before deciding to buy nitrate of soda to make cotton with which to buy all corn and hay used on the plantations and thereby lower the price of cotton and increase the price of feeds.

The above increased yields indicate that the theoretical value of the soybean for soil building may not be any greater, if as great, as the practical value. The crop grazed off the above land in 1923 would have averaged 1½ tons of hay per acre. The 1924 increase did not exhaust the plant food added by the beans. The bean crop was not grazed and turned under until March, 1924. Since the season was so dry, during the summer of 1924 it is evident that little benefit was derived from anything but the leaves and roots of the 1923 soybeans in 1924. Corn is growing on the same land in 1925. The bean plots are not suffering from drought as much as the plots which grew corn alone in 1923. It is quite evident that the effect of a good soybean crop will last from three to five years.

Table II gives the yields of corn and soybeans on the above mentioned plots in 1923 as well as on an adjacent area similarly planted in 1924. The area used in 1921 and 1922 was not adjoining that of other years. It was stiffer and the drainage poorer. The total grain yield has always been greater where both soybeans and corn were planted, except in 1924. The average yield of corn was greater on the plots on which the beans were planted three weeks later than the corn because the beans failed two years and therefore did not reduce the corn yield. It is much safer in the Delta to plant both corn and soybeans in every row at corn planting time. On land where moisture is usually the limiting factor in corn production, it is probably safer to plant the corn in wide rows and plant a row of beans between. The bean planting should not be too long delayed. The bean rows should be planted when the corn is, or within a week or 10 days thereafter.

Old soils low in organic matter and nitrogen are greatly benefitted by any legume. If the whole crop is plowed under the results are much better in the long run than if the crop is cut for hay. It is not practical to grow soybeans and turn under the whole crop but the grain may be harvested or grazed and the straw and residue turned under. When a market is developed for soybeans for crushing many areas in the Delta may be used profitably, while they are being built up, to grow soybeans for grain. The Biloxi variety looks most promising, at present for this purpose.

SOYBEANS FOR SOILING: Many farmers plant sorghum and other crops to feed green. Alternate rows of sorghum and some upright variety of soybeans will furnish a balanced ration and a maximum of feed. Hogs, cattle and idle mules will do well on the combination, or on soybeans alone.

SOYBEANS FOR SILAGE: Many experiment Stations have used soybeans alone and in combination for silage. When used alone, soybeans often produce silage with an unpleasant odor, unless very tightly packed. Equal parts of corn and soybeans, or sorghum and soybeans, produce silage which is both palatable and nourishing. Such silage is very economical for cattle and sheep and for wintering idle mules.

SOYBEAN PESTS

There are few agricultural crops which are not troubled by pests of some sort. The soybean is as nearly pest free as any of the common farm crops. To date no pest has assumed any great economic importance in soybean culture in the State. Many destructive diseases are said to attack the soybean in the Orient but there seems to be little published concerning them. Available information indicates that soybeans are affected less by destructive diseases and insect pests than most other forage and feed crops.

INSECTS: Army worms, grass worms, grasshoppers, Mexican Bean Beetles, and many other insects attack soybeans. So far grasshoppers have given more trouble in the Delta than any other insect.

Grasshoppers: Soybeans grown near oat fields, ditch banks and other areas not plowed in winter or early spring are quite apt to be injured by grasshoppers about the middle of June, if no precautions are taken. Often when oats are cut these insects migrate promptly to nearby corn and soybeans and prove very distructive.

The simplest and cheapest remedy is prevention. Below are given formulae for poison mash which may be used on ditch banks and other places where the grasshoppers first appear. The bait should be sown broadcast late in the afternoon.

No. 1. Wheat Bran 100 pounds
Crude Arsenic 5 pounds
Amyl acetate (technical grade) 3 ounces.
Molasses 2 gallons
Water 10 gallons (or enough to make a wet but not a sloppy mash)

No. 2. Bran 100 pounds.
Paris Green 4 pounds
Lemons 2 dozen (well ground)
Molasses 2 gallons
Water enough to make crumbly mass (about 10 gallons).

No. 3. Sawdust 85 pounds
Shorts 15 pounds
White arsenic 5 pounds (or
Sodium Arsenite 1½ pints)
Salt 5 pounds
Water 10 gallons.

No. 4. Sawdust 100 pounds
Salt 5 pounds
Sodium Arsenite 1 quart
Water 10 gallons
Molasses 1 gallon

In making up the baits the dry ingredients should be mixed thoroughly. The other materials should then be dissolved in the water and the two combinations mixed together. Keep livestock away from the bait.

If the grasshopper infest large areas, 1 part of Calcium Arsenate mixed with 10 parts lime, or 1 part of lead arsenate mixed with 12 parts lime, applied with regular dusting machines at the rate of 6 to 8 pounds per acre in the same way as poison is applied to cotton for boll weevil control, will effectively control them.

If dusting machinery is not available and spraying can be done the formula may be used:

Calcium Arsenate ¾ pound.
Hydrated lime, 1½ pounds
Water 50 gallons.

Mexican Bean Beetle: Where this beetle is found it is very destructive to garden beans as well as soybeans. This pest occurs in Alabama and several states farther east. Its westward progress has been very slow, but there are scattered infested areas in some east Mississippi counties. The above dust and spray mixtures will control the best if properly applied. This beetle feeds primarily on the underside of the leaves. It is necessary that the machines used to apply the spray or dust be equipped with nozzles, which direct the dust or spray upward from near the ground.

Web Worms: These little pests have been very destructive on the Station farm once or twice. It is necessary to begin control measures when the lavae or worms are small. The spray or dusting recommended for grasshoppers will control this pest if applied while the worms are young and feeding—before they web up.

Other Chewing Insects: The dust or spray recommended for grasshoppers will control any insect which undertakes to defoliate soybeans, if applied as for grasshoppers.

DISEASES: Many bacterial and fungus diseases are known to attack soybeans. Fortunately, however, few of these have been reported in the State.

Southern Blight: This disease, caused by the fungus Sclerotium Rolfsii, is rather widespread in the State. Many Delta fields were infected in 1924. In some small areas the loss was 25 to 30% of the crop. Little is know about the disease. There is no known control except crop rotation and little is known of what crops may be safely used.

It is hoped that resistant strains may be developed but no work has been reported so far. What little work has been reported on varietal susceptibility indicates that some varieties are somewhat tolerant, but not entirely resistant.

Mosiac: Soybean Mosiac was found in Connecticut as early as 1915. It has since been reported from several other states. It is rather widely distributed in the Delta.

The disease is characterized by crinkling or curling of the leaves. The symptoms resemble those which characterize mosaic diseases in general. The affected plants are stunted. The leaves are greatly puckered, usually puckering toward the upper side of the leaf. No remedy has been found so far.

Rootknot: In many sections nematodes cause severe rootknot injuries to soybeans. Nematodes are usually present where cotton wilt occurs. In sections where rootknot occurs or is suspected nematode resistant varieties should be used. The Laredo is the only resistant variety known to be adapted to the Delta section.

RABBITS: Where rabbits abound they usually give a great deal of trouble until the soybeans are rather large. The damage is usually worst nearest the woods or other hiding places. Where rabbit damage is feared the edge of the field, where they are most likely to give trouble should be planted twice as thick as where no damage is expected. Since they have the habit of feeding on the same area successively, rabbits are said to be easily poisoned. Arsenicals should be dusted or sprayed on the areas which the rabbits are damaging. The arsenicals should be diluted with lime to the strength recommended for grasshoppers. Poisoned corn, potatoes, or apples on the areas frequented by the pests are sometimes worth while.

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Bulletin 228 June, 1925

PROGRESS REPORT

ON

Cost Of Production Route In Choctaw County, Mississippi, In 1924

By

J. N. Lipscomb, Farm Economist

and

H. A. Byrd, Route Man

United States Department of Agriculture

Bureau of Agricultural Economics

In Cooperation With

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. Ricks, Director

STATION STAFF

D. C. HULL, M. Sc.....President of College
M. H. MOORE.....Secretary and Business Manager
J. R. RICKS, M. Sc.....Director and Chief in Agronomy
HUGH CRITZ, B. Sc.....Agricultural Editor
E. B. FERRIS, M. Sc.....Assistant Director, South Miss. Branch Station
C. T. AMES, B. Sc.....Assistant Director, Holly Springs Branch Station
W. E. AYRES, M. Sc., Asst. Dir. and Plant Breeder, Delta Branch Sta.
C. B. ANDERS, B. Sc.....Assistant Director, Raymond Branch Station
S. W. GREENE*.....In charge of Coastal Plains Branch Station
W. F. HAND, M. Sc., Ph. D.....Chemist
J. S. MOORE, M. Sc.....Chief in Dairy Husbandry
R. W. HARNED, B. S. A.....Chief in Entomology
K. U. JONES, B. Sc., V. M. D.....Veterinarian
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J. M. BEAL, M. Sc.....Botanist
E. P. CLAYTON,.....Poultry Husbandman
W. C. MORSE, M. Sc.....Geologist
GEORGE S. TEMPLETON, B. Sc.....Chief in Animal Husbandry
A. B. McKAY, B. Sc.....Chief in Horticulture
J. C. C. PRICE, B. Sc.....Horticulturist
D. C. NEAL, B. Sc., M. A.....Plant Pathologist
J. N. LIPSCOMB, M. Sc.....Farm Management
J. F. O'KELLY, M. Sc.....Plant Breeder
C. J. GOODELL, B. Sc.....Associate in Animal Husbandry
H. W. ALLEN, B. Sc., M. Sc.....Associate Entomologist
R. N. LOBDELL, M. Sc.....Zoologist
ROWLAND COWART, B. Sc.....Asso. Agronomist
SID NOBLE, B. Sc.....Publicity Agent
H. A. YORK, B. Sc.....Asst. at Delta Branch Station
J. B. TURNER, B. Sc.....Asst. at Delta Branch Station
H. F. WALLACE, B. Sc.....Asst. at Holly Springs Branch Station
W. S. ANDERSON, B. Sc.....Horticulturist, South Miss. Branch Station
W. C. COWSERT.....Assistant in Dairying
H. H. HARNED, M. S.....Associate Bacteriologist
MISS KITTIE SUE JOHNSON, A. B.....Secretary
MISS FANNIE PAGE.....Stenographer
D. W. McILWAIN.....Superintendent of Farm
B. V. EVANS.....Farm Foreman, South Miss. Branch Station
O. M. RYAN.....Farm Foreman, Holly Springs Branch Station
J. C. PEYTON.....Foreman, Raymond Branch Station
K. C. LIVINGSTON .....Foreman, Delta Branch Station
F. O. CORK, B. Sc.....Supt. Farm Management Vocational Project
D. MAXWELL.....Foreman and Herdsman
MISS MARY ALICE LANIER.....Addressograph Operator
H. B. BROWN, Ph. D.....Collaborator
E. C. EWING.....Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept of Agr.

PROGRESS REPORT
COST OF PRODUCTION ROUTE IN CHOCTAW COUNTY, MISSISSIPPI.

This report is for the calendar year of 1924, which is the first period of a three year study of production costs on twenty-five farms in Choctaw County, Mississippi. These twenty-five farms comprise a cost of production route which is conducted jointly by the Mississippi Experiment Station and the Bureau of Agricultural Economics of the United States Department of Agriculture. These farms are representative of the upland section of the state and to some extent representative of the upland area of the central and eastern sections of the cotton belt.

Of the twenty-five farms studied, ten farms had share croppers, the total number of share croppers on these farms being fifteen. There were also four renters on these farms, who paid one-third of the corn and one-fourth of the cotton as rent. No record was kept of the renter's man or horse labor, but the financial statement includes rents received from renters. No record was kept of the cropper's man labor, but a record was kept of the cropper's horse labor as it is customary in share cropping for all horse labor to be furnished by the land-lord as his part of the contract.

Farm Management surveys had been made of these farms for four years, beginning with the year's business of 1920. The original idea was to make a farm efficiency study, by the survey method, as a basis for recommending changes in the management of these farms which would increase farm profits. The cost of production route has worked nicely into the original plan, and we hope that our cooperators may use our cost figures in replanning their farms for greater profits. We hope that this work may also be of value to other farmers of this area and the rest of the cotton belt.

The average size of the farms on this route was one hundred and twenty acres. Of this one hundred twenty acres there was an average of 37.2 acres in crops, 37.2 acres in pastures, and 45.6 acres in woodland, waste, and farmstead. The average cash receipts per farm were $909.09. This $909.09 includes $86.56, which was the average amount received for labor performed off the farm, such as road work, carpenter work, driving school wagon, etc. Of the remaining $822.45 per farm, $480.05 was received from cotton and cotton seed, while $342.48 was received from all other farm enterprises including receipts from the sale of timber and crossties.

Of the 37.2 acres of crop land per farm, 17.05 or 45.8% were in cotton; 15.94 acres or 42.8% in corn; 1.27 acres, or 3.4%, in oats; and 2.9 acres, or 7.8% in lespedeza.

If we include croppers Labor,* which in a way is wage labor paid on a profit sharing basis, there was an average of 4058 hours of man labor per farm. Of the 4058 hours of man labor per farm, 1072 hours, or 26%, were spent on cotton; 570, or 14% on corn; 27 hours, or less than 1%, on oats; and 29 hours, or less than 1%, on lespedeza. All livestock required 740 hours, or 18.2%, and all other labor amounted to 1618 hours, or 40.1%. A large part of the labor classed as "Other Labor" consisted of work performed off the farm for which pay was received.

Since cotton is our most important farm enterprise, and since we have considerable experimental data on cotton to serve as a guide in advising changes in present production methods, it seems that the quickest way to increase farm profits in this community is to improve our cotton production practices. The Agronomy Department of the Experiment Station, under the supervision of Messrs. O'Kelly and Cowart, are conducting fertilizer and variety experiments in the community, and these experiments are proving to be splendid guides in the use of fertilizers and in the selection of varieties. On the experimental plots conducted on the farm of Mr. E. B. Smith for the crop year of 1924, the average yield of lint cotton per acre was 247 pounds. This was a little over one-half bale per acre when bagging and ties are added. The average yield for our cooperators for 1924 was 172½ pounds of lint per acre, the average for the county was 125 pounds per acre (estimated from ginner's report), and the average for the State, including the Delta, was 172 pounds per acre. We hope that the average yield of all cotton on our route may be above one-half bale by the time this study is completed. The above figures suggest that farms included in this study were getting better returns for the resources used on cotton than most other farms, similarly situated. There were, however, some wide variations among these farms in returns received for the use of labor and capital. As an example of this variation some of these farms produced cotton at about one-half the cost of producing it on other farms. One of the big causes of variation in yields on different farms was fertilizer. Our experiments and observations indicate that a heavier use of fertilizer would increase profits on cotton. Another factor which does not show up in our data and which is not under our control was rain, as a part of the community received a much needed rain in July which the rest of the community did not. Some of the factors under our control which influence cotton yields

*Cropper labor calculated on the basis of average per acre requirements for the crops on these farms.

and reduce costs per pound are proper fertilization, close spacing, regular stands, and approved varieties. Steps are being taken by our cooperators to take advantage of improvements that may be made in these practices.

After cotton, corn is our most important crop. Our community yield was 18 bushels per acre as compared with the state average of 12 bushels. Good corn land is limited on most farms. A large acreage of corn competes with cotton for both land and labor. The ten year average farm price of corn in Mississippi from 1914 to 1923 was $1.03 a bushel. The average farm price of cotton for the same period was twenty-two cents a pound. An acre of corn that uses 50 hours of man labor and 35 hours of horse work per acre and yields 15 bushels per acre worth $1.03 a bushel will return about 12 cents an hour for man labor and about 12 cents an hour for horse work with the farm machinery and other expenses thrown in. These figures allow one-third of the yield as land rent.

An acre of cotton using 100 hours of man labor and 40 hours of horse work and for which one-fourth of the cotton and seed are paid as rent would have to produce 100 pounds of lint per acre in order to pay the same rate for man and horse labor as corn would pay at 15 bushels per acre.

At the prices suggested, the corn rent would be $5.16 and the cotton rent would be $5.50. In this comparison the cotton seed were allowed to pay for the fertilizer and ginning. This suggests that it is a doubtful practice to use any considerable amount of land and labor for corn that could be used for cotton, unless the chances for fifteen bushels of corn per acre are as good as the chances for 100 pounds of lint cotton. In fact, any man growing 15 bushels of corn or one-fifth bale of cotton per acre will have to work on a very low scale of wages. There is, no doubt, considerable improvement to be made in corn production, and experimental data are much needed as a guide for recommending changes in the growing of this important crop. Corn on fertile soils is a profitable crop, but on poor land it is a time and money loser.

Dairying has become a rather important industry in the community, but had two handicaps for 1924. First, owing to the extremely dry summer the pastures were below normal thereby reducing butter-fat production and increasing costs; second, the price of butter-fat was low compared to the price of other farm products. Our records show (see table on dairy cattle) that cows on these farms received an average of less than one-half a ton of hay per cow for the year. This is about half as much hay as is used by farmers in the older dairy sections of the state, while dairy authorities think that butter-fat costs could be lowered by still larger use of roughages. Good pastures and cheap roughage are essential to low butter-fat costs. The pastures in this

community are fairly good during a normal year, but hay production is usually below the farm need.

Pork production has a rather small place on most of these farms, owing to the scarcity and high value of feed. It appears that a marked increase in soil fertility or the production of soy beans or possibly peanuts as a supplementary crop would bring pork production into greater prominence. On farms with land that will grow 20 bushels or more of corn per acre, possibly more land can be profitably planted to corn for hogs.

Taking this study as a whole we find that from the standpoint of both volume and profit, cotton seems to be our leading enterprise. It is possible that the unusually dry season of 1924 gave cotton an advantage over other crops and livestock, as very little damage was done by boll weevils. In the light of our present experimental data regarding the possible improvements that can be made in the production of the various farm products, it seems that with the present price ratio cotton will continue to be our most profitable enterprise. With cotton as the principal crop, however, much time and land will be left for supplementary enterprises.

PRODUCTION OF COTTON

Labor, Material Requirements and Yield per Acre

Choctaw County, Mississippi — Year 1924

Farm No.**	No. Acres	Labor: Man Hrs.	Labor: Horse Hrs.	Seed (Bu)	Manure (Tons)	Fertilizer: Phosphate (Lbs.)	Fertilizer: Nitrate (Lbs.)	Fertilizer: Mixed (Lbs.)	Value $	Yield (Lint)	Yield (lbs.)
10	3.27	*203.1	99.8	1.22	1.83	244.6	61.2	———	3.52		310
1	3.72	*237.1	80.1	1.08	8.06	295.7	107.5	———	5.19		269
20	6.00	159.9	57.8	1.67	3.00	300.0	150.0	———	6.41		268
22	9.54	119.4	47.1	1.26	———	272.5	83.8	———	4.36		256
12	7.43	92.8	38.6	1.48	.53	289.4	46.0	———	3.42		203
4	4.85	82.0	38.9	1.03	———	226.8	24.1	———	2.35		198
21	6.02	102.3	52.6	1.50	1.33	199.3	66.4	83.1	4.66		197
16	11.42	164.1	54.1	1.05	.53	218.9	56.5	———	3.20		192
23	19.85	122.4	57.7	.50	———	120.9	75.6	———	3.01		180
11	11.89	75.1	39.3	.88	.33	117.8	12.6	58.9	2.16		171
2	16.19	113.0	29.1	.77	———	92.6	———	111.2	2.46		169
13	5.99	70.4	34.9	.50	.53	133.6	50.1	———	2.39		166
25	20.10	120.2	43.7	1.24	———	139.3	49.8	———	2.42		164
6	6.50	92.2	34.9	1.23	.92	211.5	38.5	———	2.64		159
5	7.81	90.6	34.9	1.54	2.18	204.9	32.0	———	2.41		157
19	4.00	127.4	59.0	1.25	———	135.0	90.0	———	3.52		150
3	10.00	123.4	44.4	1.80	.75	200.0	65.0	———	3.30		150
18	16.86	109.5	41.5	1.19	———	132.4	60.3	———	2.66		146
24	19.89	75.4	30.2	.48	.25	65.4	———	55.3	1.37		143
15	5.81	127.5	48.1	1.20	———	180.7	51.6	———	2.78		140
14	8.30	69.4	30.8	1.20	———	36.1	———	96.4	1.81		139
7	9.37	* 41.7	28.0	.64	———	117.4	45.4	———	2.14		92
Wt. Av.	9.76	108.6	43.2	1.04	.53	156.6	46.6	22.8	2.82		172.5

How to figure the cost of cotton production. (Problem based on the average figures).

Man Labor	108.6	x	$ .15	$16.29
Horse Labor	43.2	x	$ .12	5.18
Seed	1.04	x	$ .60	.62
Manure	.53	x	$1.00	.53
Fertilizer—Acid Phosphate (156.6x$14.75) divided by 2000				1.16
Nitrate of Soda (46.6x$56.00) divided by 2000				1.30
Mixed (22.8x$1.60) divided by 100				.36
Equipment at $.02 per horse hour				.86
Total cost per acre				$26.30
Cost per pound of lint, $26.30 divided by 172.5				.15

(In the above example, it is assumed that cotton seed credit is equivalent to ginning and wrapping and land rent.)

*Labor is questionable but is given as reported.

**Farms are listed in order of yield, beginning with the highest.

PRODUCTION OF CORN

Labor, Material Requirements and Yield per Acre.

Choctaw County, Mississippi. Year 1924.

Farm No.	No. Acres	Labor: Man Hrs.	Labor: Horse Hrs.	Seed (lbs)	Manure (Tons)	Fertilizer: Acid Phosphate (lbs.)	Fertilizer: Nitrate (lbs.)	Fertilizer: Mixed (lbs.)	Yield (bu.)
1	9.07	61.9	49.8	9.9	———	143.3	———	———	30.9
2	14.21	46.6	25.8	10.0	———	30.2	———	14.1	11.8
3	16.51	43.8	37.7	10.0	.45	———	———	———	10.6
4	8.47	46.0	36.1	8.7	———	41.3	57.0	———	18.9
5	9.97	43.3	27.6	9.0	———	———	24.7	———	7.7
6	9.20	35.4	34.0	8.9	———	54.3	27.2	———	18.4
7	12.89	43.0	31.3	10.1	.81	124.1	33.0	———	16.8
8	18.83	56.1	50.7	10.0	———	———	———	———	23.4
9	9.18	47.5	50.1	10.0	———	207.0	113.3	———	13.3
10	11.52	77.5	61.0	10.0	———	173.6	———	———	29.9
11	13.15	54.9	38.2	10.0	———	15.2	———	———	23.9
12	15.57	36.3	27.1	10.0	———	72.9	6.4	———	11.3
13	10.83	28.2	23.2	10.0	———	———	———	———	15.9
14	7.28	36.9	32.1	10.0	.34	———	———	———	14.8
15	7.47	44.4	30.4	10.0	———	———	———	———	13.9
16	16.94	65.4	43.9	10.0	———	1.5	———	———	12.9
17	16.00	35.7	32.8	10.0	———	68.8	13.8	———	15.6
18	17.50	39.9	31.8	10.0	.14	37.1	8.6	———	21.8
19	9.00	66.7	52.3	10.0	———	100.0	———	———	15.1
20	13.00	35.5	25.7	10.0	———	46.2	7.7	———	15.2
21	5.60	67.0	51.2	10.0	.89	151.8	32.3	———	32.1
22	9.78	51.6	31.3	10.0	———	40.9	20.4	———	22.9
23	6.11	75.5	52.9	10.0	———	———	———	———	28.0
24	11.15	58.1	39.6	10.0	———	———	———	17.9	23.8
25	11.10	54.7	44.5	10.0	———	18.0	———	———	15.9
Wt. Av.	11.61	49.1	37.8	9.9	.10	58.6	11.7	1.4	18.0

How to figure the cost of corn production. (Example based on the average figures.)

Man Labor	49.1 x $.15	$ 7.36
Horse Labor	37.8 x $.12	4.54
Seed	(9.9 x $1.00) divided by 70	.14
Manure	.10 x $1.00	.10
Fertilizer—Acid Phosphate	(58.6 x $14.75) divided by 2000	.43
Nitrate of Soda	(11.7 x $56.00) divided by 2000	.33
Mixed	(1.4 x $1.60) divided by 100	.02
Equipment at $ .02 per horse hour		.76
Total cost per Acre—not including land rent		$13.68
Cost per bushel, not including land rent, $13.68 divided by 18		.76
Cost per bushel allowing one-third of yield as rent		1.24
Rent received per acre allowing one-third as rent (6 x $1.25)		7.50

PRODUCTION OF LESPEDEZA HAY

Labor, Material Requirements, and Yield per Acre.

Choctaw County, Mississippi. Year 1924.

Farm Number	No. Acres	Labor		Seed	Yield
		Man Hrs.	Horse Hrs.	(Bu.)	(Tons)
1	8.00	18.7	24.2	.50	.94
4	3.50	10.9	20.6	.50	.85
5	3.50	9.3	11.1	.50	.85
6	4.50	3.1	6.2	.50	1.22
7	3.00	8.3	10.0	.50	1.00
8	12.00	10.0	18.1	.50	1.60
10	3.00	18.7	27.0	.50	2.19
11	2.00	19.2	28.5	.50	.75
13	2.50	15.0	20.8	.50	.60
14	2.50	15.6	24.0	.50	.60
17	11.00	2.4	4.0	.50	.27
18	5.00	11.0	20.2	.50	.80
19	2.50	29.2	44.4	.50	1.00
20	3.00	11.7	12.0	.50	.92
21	1.00	43.0	30.0	.50	1.50
22	1.00	28.0	40.0	.50	1.00
24	1.75	17.1	17.1	.50	1.71
Wt. Av.	4.10	12.1	17.4	.50	.90

Average stand of Lespedeza—2 years.
One-half of seed sown is charged this year.

PRODUCTION OF OATS

Labor, Material Requirements and Yield per acre.

Choctaw County, Mississippi. Year 1924.

Farm No.	No. Acres	Labor		Seed	Fertilizer	Yield
		Man Hrs.	Horse Hrs.	(Bu.)	Nitrate (lbs.)	(Bu.)
2	1.00	40.0	19.0	1.5	———	25.0
4	1.50	18.0	25.3	1.5	———	25.0
5	1.50	16.7	13.3	1.5	———	25.0
9	4.00	19.8	31.8	1.5	———	12.5
13	2.50	21.4	11.0	1.5	———	16.0
14	2.50	22.8	19.2	1.5	———	16.0
17	6.00	13.7	9.5	1.5	———	26.7
19	6.00	23.2	16.0	1.5	33.3	16.7
21	1.75	41.4	32.6	1.5	42.8	42.8
23	2.00	20.0	8.0	1.5	———	25.0
24	1.75	14.3	28.6	1.5	———	17.1
Wt. Av.	2.77	21.0	18.2	1.5	9.0	21.1

No twine used. Cut with mower or cradle.

WORK STOCK

Unit Requirements per Year for One Head of Work Stock.

Choctaw County, Mississippi — **Year 1924.**

Farm No.	No. Horses	Corn (Bu.)	Oats (Bu.)	Other Grain (lbs.)	Hay (lbs.)	Fodder & Tops (lbs.)	Pasture Days	Labor Man Hrs.	Labor Horse Hrs.	Cash Costs $	Hours Worked
1	3	28.5	——	——	887	——	100	53.6	1.2	——	808
2	5	23.6	15.5	499	228	——	98	43.8	3.3	——	422
3	3	25.2	22.9	——	786	——	89	55.3	——	——	698
4	2	26.4	8.6	395	579	——	86	79.5	1.2	.75	918
5	2	25.2	1.6	54	484	——	187	55.8	3.0	.60	308
6	2	41.3	——	372	1639	——	183	87.2	——	——	937
7	2	27.0	——	——	985	——	126	78.2	——	——	546
8	8	27.8	——	——	593	——	68	38.4	3.6	——	635
9	2	28.3	——	——	1188	——	192	87.1	11.0	——	642
10	4	35.6	——	——	1967	——	102	66.8	2.4	——	513
11	2	35.2	——	——	1638	167	116	95.2	——	——	892
12	4	25.4	1.2	25	954	——	50	61.3	——	.38	385
13	1	35.3	8.5	——	75	341	91	63.2	12.8	——	974
14	2	32.2	10.8	15	356	233	195	98.4	2.0	——	442
15	2	12.4	9.0	550	232	——	150	113.8	1.5	——	324
16	3	31.5	——	——	993	222	207	87.9	.8	——	762
17	2	40.3	——	——	1277	31	84	34.9	——	——	468
18	3	22.4	——	——	855	——	122	36.4	2.8	——	676
19	2	16.0	18.3	——	184	54	131	63.7	——	——	773
20	2	25.8	——	752	750	——	130	37.0	.8	——	613
21	2	27.2	2.4	——	1050	——	214	38.9	4.8	——	581
22	4	40.5	2.4	128	1974	——	69	78.8	4.1	——	601
23	3	40.5	6.5	——	548	——	126	99.4	——	——	563
24	3	28.0	4.7	——	1334	62	164	84.1	——	——	542
Wt. Av.	2.8	29.4	4.1	97	939	33	119	65.4	2.1	.06	611

How to figure the cost of horse labor. (Example based on average figures.)

Man Labor	65.4 x $ .15	$ 9.81
Horse Labor	2.1 x .12	.25
Corn	29.4 x $1.00	29.40
Oats	4.1 x $ .60	2.46
Other Grain	97 x $ .02¼	2.18
Hay	(939 x $15.00) divided by 2000	7.04
Fodder	(33 x $15.00) divided by 2000	.25
Pasture	(119 x $ .03)	3.57
Depreciation (average for the 24 farms)		9.08
Interest and Taxes (average for the 24 farms)		7.52
Cash Costs (Shoeing, medicines, etc.)		.06
Total cost per horse per year		$71.62
Cost per hour of horse labor $71.62 divided by 611		$ .12

(In the above example, it is assumed that manure credit is equivalent to equipment and building charges.)

Farm No.	No. Cows	Cotton-seed Meal (lbs)	Sweet Feed (lbs)	Shorts (lbs)	Other Feed (lbs)	Cotton-Seed (lbs)	Total Concen-trates (lbs)	Hay (lbs)	Cottonseed Hulls (lbs)	Total Roughage (lbs)	Pasture Days	Labor: Man Hrs.	Labor: Horse Hrs.	Butterfat (lbs)
1	8.4	297.4	96.4	——	——	278.3	672.1	687.1	——	687.1	259	78.6	10.5	164.2
2	6.5	227.8	339.8	60.5	——	73.8	701.9	——	522.8	522.8	225	76.9	18.0	139.3
3	2.5	487.2	——	——	——	48.8	536.0	337.6	——	337.6	256	87.0	2.1	129.6
4	3.0	344.3	539.0	99.0	——	122.7	1105.0	1077.0	217.0	2094.0	193	96.7	8.2	151.6
5	4.0	364.5	441.0	65.2	48.0	296.5	1215.2	1100.8	183.0	1283.8	206	96.6	.5	122.3
6	6.6	256.5	——	——	——	——	256.5	1293.9	572.6	1866.5	199	97.2	——	84.0
7	3.0	——	40.0	180.0	147.4	202.6	570.0	272.3	——	272.3	193	64.7	——	85.8
8	13.5	1185.6	114.8	244.1	23.0	——	1567.5	248.0	594.7	842.7	244	109.2	11.4	173.6
9	2.0	593.5	——	61.5	198.5	——	853.5	705.0	186.0	891.0	198	130.9	22.5	233.8
10	4.0	146.0	——	——	169.8	306.0	621.8	1142.5	52.2	1194.7	213	49.8	2.1	63.4
11	5.0	346.0	——	113.0	——	329.0	788.0	569.4	——	569.4	220	73.4	6.6	135.4
12	4.5	76.4	56.7	——	24.9	177.3	335.3	1120.4	161.1	1281.5	230	87.1	——	90.2
13	2.0	151.5	——	——	——	396.5	548.0	108.5	555.5	664.0	244	78.1	2.6	91.5
14	4.0	277.5	——	——	——	92.5	370.0	77.5	578.2	655.7	274	85.0	19.2	106.8
15	2.0	488.5	——	——	46.5	400.0	935.0	——	491.5	491.5	168	103.2	1.5	91.4
16	4.0	213.5	——	——	92.0	92.0	397.5	591.5	——	591.5	190	94.0	——	34.5
17	7.5	581.1	406.0	——	247.2	195.2	1429.5	705.7	——	705.7	204	82.4	1.3	127.9
18	2.6	47.6	——	——	525.0	163.8	736.4	111.9	——	111.9	187	84.3	6.3	60.5
19	5.0	365.0	85.4	——	36.6	188.2	675.2	——	117.0	117.0	256	103.4	6.2	113.1
20	4.4	356.1	147.9	——	95.0	194.5	793.5	445.2	——	445.2	208	81.5	1.5	81.3
21	5.0	696.0	275.0	39.6	12.0	——	1022.6	797.8	——	797.8	244	107.8	4.5	147.6
22	8.2	393.0	24.1	76.2	——	——	493.3	816.1	656.4	1472.5	212	93.2	15.6	130.5
23	1.0	424.0	——	——	648.0	457.0	1529.0	403.0	——	403.0	244	141.5	——	220.0
24	2.0	309.5	——	——	——	488.0	797.5	1018.0	——	1018.0	214	116.2	——	115.0
Wt. Av.	4.6	434.4	126.7	56.9	64.3	146.5	828.8	626.9	255.4	882.3	224	90.8	7.0	124.2

How to figure the cost of butterfat production. (Example based on average figures.)

Depreciation, interest, and taxes		$ 5.00
Man Labor	90.8 x $ .15	13.62
Horse Labor	7.0 x $ .12	.84
Concentrates	828.8 x $ .02¼	18.65
Hay	(626.9 x $15.00) divided by 2000	4.70
Cottonseed Hulls	(255.4 x $ .90) divided by 100	2.30
Pasture	224 x $ .03	6.72
Total cost per cow per year		51.83
Cost per pound of butterfat	($51.83 divided by 124.2)	$ .41

In the above example, it is assumed that manure credit is equivalent to equipment and building charges.

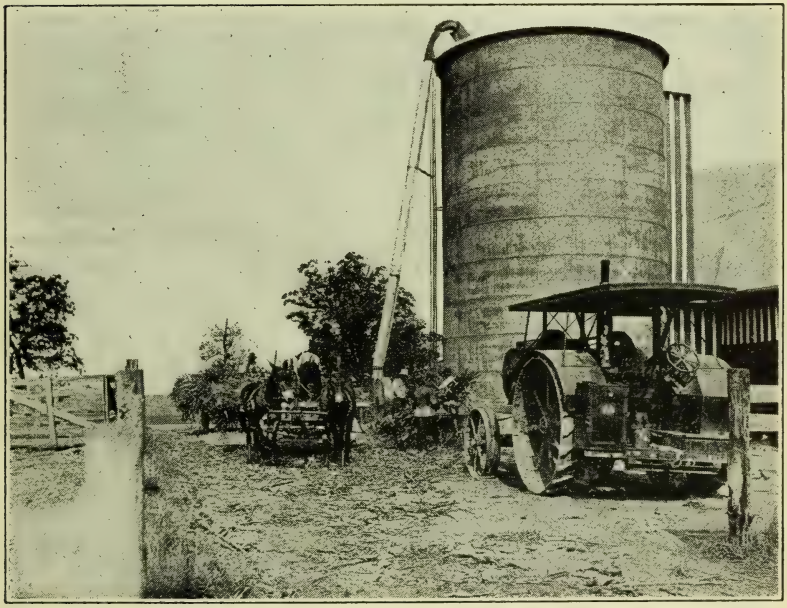
The average value per cow was $26.00, average age was 6 years.
Interest 8%, Taxes 2%, Depreciation 12%, Beef or canner value..... $6.00

Bulletin 229 June, 1925

SILAGE AND SILAGE COSTS IN MISSISSIPPI

By

J. N. Lipscomb and C. J. Goodell



Filling Silo at Beef Cattle Barn, Mississippi Experiment Station

J. R. Ricks, Director
Mississippi Agricultural Experiment Station
A. & M. College, Mississippi

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K. C. Livingston ---------- Farm Foreman, Delta Branch Station
F. O. Cork, B. Sc. ------Supt. Farm Management Vocational Project
H. B. Brown, Ph. D. ---------- Collaborator
E. C. Ewing, M. Sc. ---------- Collaborator

*In co-operation, Bureau Animal Industry, U. S. Department of Agriculture.

A STUDY OF SILAGE COSTS IN MISSISSIPPI

SUMMARY

The average yield per acre of corn silage on the farms studied in this survey was 6.1 tons. The average yield per acre of sorghum silage was 8 tons.

The amount of corn that could be produced per acre on the land used for silage purposes with the same labor as was given to the production of silage was estimated at 25.5 bushels. According to these estimates the same land and labor required to produce one ton of corn silage would produce 4.2 bushels of corn. Similarly, the land and labor required to produce one ton of sorghum silage would produce 3.2 bushels of corn.

From data secured in this survey and on the Mississippi Experiment Station farm, it would seem that silage produced on rich land, well tended, will contain a considerably higher proportion of grain than that grown on ordinary good land with average methods of cultivation.

An average of 5.1 man hours and 2.8 horse hours were required for the harvesting of one ton of silage.

Where available for this purpose, the hiring of ensilage cutter and power was considered more economical than owning except where tractors were needed for other farm work.

The custom charge of fifty cents per ton compared closely to machinery and fuel costs for filling silos on the Experiment Station farm.

ESTIMATING COST OF CORN SILAGE

The following method is recommended for calculating corn silage costs where data are to be used in connection with the choice of farm enterprises:

Charge		Amount
4.2 Bushels of Corn at $1.00	$4.20	
Less Cost of Cribbing 4.2 Bushels of Corn	.25	
	$3.95	$3.95
5.1 Man Hours at 10 cents		.51
2.8 Horse Hours at 10 cents		.28
Machinery Charge		.50
Total		$5.24

The charge of one dollar per bushel for corn is based on the average farm price in Mississippi over a period of ten years, as given by the United States Department of Agriculture. The cost of gathering corn from the field was estimated at six cents per bushel.

COST OF SORGHUM SILAGE

The cost of sorghum silage should be estimated in similar manner except that a charge of the value of 3.2 bushels of corn should be made.

Charge		Amount
3.2 Bushels of Corn at $1.00	$3.20	
Less Cost of Cribbing 3.2 Bushels of Corn	.19	
	$3.01	$3.01
5.1 Man Hours at 10 cents		.51
2.8 Horse Hours at 10 cents		.23
Machinery Charge		.50
Total		$4.30

As these estimates are based on the average costs on twenty-five farms, farmers or others using these methods of calculating silage costs should substitute figures adapted to their individual cases.

From this study it would seem that filling costs could be reduced by more cooperation on the part of silo owners, both in the exchange of labor and in the ownership of machinery.

More rapid filling should lead to reduction of man and horse hour requirements.

The use of the corn binders and underslung wagons might reduce costs where the tonnage justifies such special equipment.

Costs of producing the crop could probably be reduced by the increased yields which would be secured from better cultivation and fertilization of land used for the growing of silage crops.

INTRODUCTION

The present upward trend of livestock prices, it is generally agreed, is the beginning of a gradual relative rise which will continue over a number of years. As the low prices of the past few years resulted in a decreased interest in livestock, the advance will result in an impetus that should be intelligently used in establishing the livestock industry of the state upon a permanent foundation.

Mississippi has a large percentage of unused land, best suited for pasture purposes, which must be taken into consideration in any plan for farm organization. Competing with cotton production perhaps less than any other supplementary enterprise, at the same time showing larger returns from labor expended, grazing offers one of the most promising means of increasing farm revenues. For this reason, grazing animals such as cattle and sheep may fit into the average farm plan better than grain consuming livestock such as hogs, as the latter class competes with cotton for grain needed to feed work stock.

The greater portion of the expense of a beef herd is for feed during the three or four winter months. With cottonseed meal available the problem of the beef producer is more the selection of economical roughages than concentrates. To a lesser degree this is also true of the dairyman.

FEED CHARGES BASED ON MARKET VALUES

Where farm prices are known and there are sufficient data at hand as to their feeding value for the particular class of stock, a comparison of the economy of different feeds is simple. In such cases feeds will be charged against a livestock enterprise at the farm value which will be based on the market price. In communities where a surplus of the particular feed is produced on farms and the feed customarily sold, the feed will be charged against the livestock to which fed at the market price less the cost of marketing. On the other hand, where the feed is customarily purchased it should be charged, whether produced on the farm or not, at the prevailing farm price which is usually the market price plus transportation charges therefrom.

CHARGING SILAGE AGAINST LIVESTOCK ENTERPRISE

While in the case of concentrates and hay these rules can be readily applied, they are not as easy of application in the case of silage, where no market value exists. Silage usually competes directly with corn for the factors of production: land, labor, and capital. Corn silage on land which will produce corn for grain profitably should, therefore, be charged against livestock enterprises at the value of the corn contained plus the difference between the cost of ensiling or harvesting and the amount which it would have cost to gather and crib the corn. Similarly, sorghum silage should be charged on the basis of the corn that, according to estimate, would have been produced on the area used for silage purposes. Up to the present no uniform method has been used in charging silage against livestock enterprises. In some instances attempts were made to estimate roughly the cost of production, but, though surveys have shown the cost of producing both corn and sorghum, little accurate data have been available on the cost of filling the silo after the crop was made. The weakness of any method of calculating silage costs, ignoring the value of the corn which could have been produced on the same land with the same labor, is at once apparent when such data are to be used in connection with the selection of farm enterprises.

SILO CONSTRUCTION AT STANDSTILL

The excellence of silage for both dairy and beef animals has been experimentally proved and the results generally sustained by demonstration and farm practice; yet in spite of a perennial shortage of farm roughages, silo construction has been at a standstill in the state for the past five years. A preliminary report issued in April, 1923, by D. A. McCandliss, Agricultural Statistician, showed only seven hundred and forty-seven silos in the state. This report, while admitted to be incomplete, indicates that even after several years of effort to introduce them into the state, silos still bear in number an insignificant ratio to farms on which are maintained dairy and beef herds. Of concern also in this connection has been the considerable number of silos during the past few years that have remained unfilled. Where of

wood construction, many of these have been so neglected as to be of little or no value at the present time. These conditions may have been due in part to the recent depression in livestock values and in part to excessive costs. A careful study of these conditions was made by the Agricultural Economics Department in the fall of 1923.

SURVEY OF FILLING COSTS

As data were available on other points essential to the calculation of silage costs, a survey was planned to determine the basic expenditure in connection with harvesting the crop. This was accomplished in most instances by means of personal visits to farms. With the assistance of the farmer, blanks were filled out giving information in regard to the following points:

Crop used
Acreage in crops
Dimensions and kind of silo
Distance of hauling
Kind and size of cutter used
Kind of power used
Man and horse hours required for setting up cutter, pipes, etc.
Man and horse hours required for cutting crop in the field.
Man hours required for loading from the field
Man and horse hours required for hauling from the field
Man hours required for putting crop into cutter
Man hours required for running engine
Man hours required for tramping in silo
Man hours required for sharpening knives
Miscellaneous labor required

Where possible, information was also secured on the cost of labor, the amount of fuel and lubricating oil, and the depreciation of machinery.

All data collected were checked in the field as carefully as possible under the conditions of the survey. Where necessary, measurements were made of the size of field and dimensions of silos. The amount of silage harvested in each instance was calculated by the use of tables published jointly in Missouri Bulletin 164 and Kansas Circular 89.

The work was also checked by carefully kept records of filling costs on the College and Station farm. In some of these instances the crop was weighed into the silo. Yields of corn were determined on the Station farm by counting and averaging the number of ears on fiftieth acre strips (250 feet of row) in representative portions of the field. Weights of a hundred representative ears were secured from portions of rows left in different parts of the field ungathered until sufficiently dry for harvesting and cribbing. From these data estimates were made of the yield of feed corn which would have been secured. These data are herein used only in support of that collected in the field.

ACKNOWLEDGEMENT

Acknowledgement is hereby made to the farmers supplying this information and to county agents, J. V. Pace and R. M. Lancaster, for their assistance in connection with the making of this survey.

SUMMARY OF FILLING TWENTY-FIVE SILOS—MISSISSIPPI

No.	Crop	Tonnage	Yield per acre. (Tons)	Labor	
				Man Hours	Horse Hours
1	Corn and Soybeans	60	5.5	4.93	2.40
2	Corn, Sorghum, and Johnson Grass	85	7.73	6.01	2.42
3	Sorghum	90	10.0	6.33	1.78
4	Sorghum	150	10.0	3.00	2.00
5	Sorghum	94	10.0	6.91	2.55
6	Corn	61	3.4	6.13	3.93
7	Sorghum	115	9.0	3.40	1.95
8	Sorghum	140	4.0	8.50	2.57
9	Corn	240	6.0	2.03	1.83
10	Corn	80	6.1	3.94	2.45
11	Corn and Sorghum	95	9.5	6.31	3.16
12	Sorghum	45	3.0	3.56	4.00
13	Sorghum	100	10.0	5.60	3.20
14	Corn and Soybeans	100	4.2	1.43	1.80
15	Corn	95	8.0	4.42	2.53
16	Corn and Soybeans	80	12.3	4.68	3.75
17	Corn	87	6.0	3.86	3.31
18	Sorghum	63	10.0	7.62	4.44
19	Corn	80	5.9	4.90	3.44
20	Corn and Sorghum	100	5.5	5.29	3.00
21	Sorghum	40	6.2	5.50	2.80
22	Corn and Sorghum	95	4.75	5.68	3.37
23	Sorghum	120		4.17	2.91
24	Corn	100	7.5	6.75	2.80
25	Corn and Sorghum	45	3.75	7.58	2.44

It will be noted from this table that in fifteen of the twenty-five instances sorghum was used.

The average yield of sorghum silage was 8 tons per acre as compared with 6.1 tons in the case of corn silage, the former yielding thirty-one percent more than the latter. In the case where corn and sorghum were mixed in the silo the average yield was 7.7 tons.

The average yield of corn which might have been expected from the land in silage was estimated at 25.5 bushels. This estimate is based on a comparatively small number of instances and might be revised as the result of a more extensive survey. From these data a charge of the field value of 4.2 bushels of corn should be made against each ton of corn silage. Likewise, a charge of the value of 3.2 bushels of corn should be made against each ton of sorghum silage. As the data herein are based almost wholly on a single year's work, these results may fail to adequately show the greater dependability of sorghum

than of corn. Agriculturists generally have estimated that sorghum will out-yield corn by nearer fifty than thirty percent.

On the Station farm a careful estimate showed that each ton of corn silage put into the concrete silo at the steer barn contained seven bushels of corn. These data indicate that silage produced on rich land, well tended, will contain a considerably higher proportion of corn than that grown on ordinary good land with average methods of cultivation.

The average time required for setting up cutter, pipes, etc., was 9.7 man hours. The average man hours required for harvesting one ton of silage was 5.1, while the average horse hours was 2.8. The distribution of man labor in the different operations was as follows:

Cutting Crop	26.8%
Loading	14.2%
Hauling	20.2%
Feeding Cutter	13.8%
Tramping	15.8%
Overseeing and Miscellaneous	9.2%

ESTIMATE OF TIME REQUIRED AND DISTRIBUTION OF LABOR IN FILLING 100 TON SILO

According to this study the harvesting of a hundred tons of ensilage required on an average the labor of nineteen men for about twenty-seven hours, or nearly three days.

The distribution of labor was approximately as follows:

1 man, overseeing
5 men, cutting crop in field
3 men, loading on wagons
4 men, hauling
3 men, at the machine, feeding cutter, tending machine, etc.
3 men, tramping in silo.

MACHINERY

The cutters used in the majority of instances were of the radial knife type with ten to twelve inch throat.

Power was supplied by tractors ranging from 6-12 H. P. to 15-30 H. P., 10-20 H. P. being the most common.

With one or two possible exceptions the cutters were not run nearly up to their normal capacity of three-fourths to one ton per hour for each inch in width of throat.

In about half of the instances the cutters and power were owned by the farmer, while in the rest these were hired. The owner of the engine and cutter in all instances had purchased the machinery primarily for his own use.

Where custom work was done the charge was generally about fifty cents per ton where the owner of the machinery furnished engine,

cutter, fuel, oil, and one man. In some instances the owner of the machinery furnished the engine, cutter, fuel, oil, a corn binder, two men and three horses, charging for these seventy-five to eighty cents per ton. The cost of cutters where ascertained was about $350.00.

Corn binders were used in only four instances. Where given, the cost of the corn binder was $175.00.

The cost of tractors showed more variation than that of other silage machinery as the kind and horse power was dependent largely on their general farm use. As tractor prices are readily available in all parts of the state these data are not given.

The average oil and fuel requirements per hundred tons were approximately three gallons of cylinder oil and fifty gallons of gasoline or kerosene, the latter being used in most instances.

Machinery charges were not calculated, owing to the variation in the number of silos filled by different machines and to the variation in the number filled by the same machine in different years, also because the tractors were used in all cases for other than silo filling purposes.

The custom charge of fifty cents per ton is considered sufficiently accurate to cover such costs, for while including the labor of one man it does not include the instances of binder charges and other costs. This compares very closely to the machinery and fuel cost of fifty-three cents per ton for filling silos on the Experiment Station farm.* In the majority of cases where silage machinery can be hired, this method is preferred to owning and is probably more economical, especially on small jobs. The average length of haul was estimated at seventy-two rods or a little less than a quarter of a mile.

The amount which the farmer can afford to invest in silage machinery can be readily figured by estimating the saving as a result of ownership, subtracting expense for repairs, etc., and dividing by the current interest rate.

SILAGE YIELDS AND MAN AND HORSE HOUR REQUIREMENTS FOR FILLING SILOS IN OTHER STATES

(These figures were secured from the Year Book of the United States Department of Agriculture.)

	Yield		Labor Requirements per ton of Silage put in Silo. Man Hours	Horse Hours
Minnesota—Average of 30 Records	7.1	Tons	1.44	2.21
Wisconsin—Average of 97 Records	9.4	"	1.66	2.07
Iowa—Average of 55 Records	9.8	"	1.53	2.04
New York—Average of 83 Records	13.0	"	1.97	1.51

*Thesis prepared for M. S. Degree, Mississippi A. & M. College, by I. P. Trotter.

A comparison of the results secured in this survey with those reported from the states listed above shows that silage yields in Mississippi are lower in most instances and that the labor requirements are greater per ton of silage put into silo.

The yields in Mississippi can be greatly increased by limiting the production of silage to the soils best adapted to its production and by improving these better adapted fields by returning the manure and by growing leguminous cover crops. On most farms in the state, there is a limited amount of good corn land that will compare favorably in production with lands in any section of the country. Sufficient instances of high yields have been recorded to show the possibilities of silage production in this state. Better cultivation and fertilization would have increased the yields on probably all of the farms studied.

Some of the reasons for high labor requirements are the character and training of the labor, double handling of the crop, the scattering number of silos, and long hauls from the field to the silo.

Practices which will tend to decrease the time and expense required in filling are: keeping the corn or sorghum up to the machine, unloading directly on to the feeding table; and feeding the bundles of corn or sorghum into the machine, butts foremost and stalks parallel and overlapped, in such a manner as to have at all times the steadiest possible load on the engine.

With a 10-20 H. P. engine and a twelve inch cutter, at least fifty tons of silage should be put in the silo in ten hours under favorable conditions.

Hauling corn or sorghum from the field to the cutter will require from four to six teams, or even more, depending upon the distance. The teamsters should help load, though it will usually require two additional hands loading in the field. The hauling of full sized loads, especially in the case of long hauls, will help in lowering the man and horse hours required. Where the tonnage justifies such special equipment, low-down or underslung wagons will reduce labor.

One or possibly two men will be required at the machine to feed the cutter, look after the engine, and tend to other odd jobs.

Where the distributor is used, two good hands should be sufficient in the average silo to mix and tramp the silage. It is important that this work be thoroughly done in order to prevent spoilage and as supervision is difficult reliable help should be used. The distributor is made of jointed steel sections and extends down into the silo fifteen or twenty feet from the end of the blower pipe. By means of a rope attached to the end of this distributor, the latter may be pulled around and the silage placed where desired by one of the trampers.

In the field the number of men required for cutting the crop with knives will vary considerably with the yield of the crop. Where they start a half day in advance of the cutter, four men should be sufficient, though it may be safer to have a lead of a day. A corn binder will reduce the man hour requirements. The advisability of purchasing a

binder will depend of course on the acreage to be cut each year. Six acres is probably a good day's work for a binder and three mules. The amount which the farmer can afford to pay for a binder can be calculated as for other silage machinery.

Fields for silage crops should be located as close as possible to the silo in order to reduce the expense of handling the crop and make easier the restoration of fertility. As silage removes a large amount of plant food from the soil, these fields should not only receive regular applications of manure but should be planted to leguminous cover crops.

GENERAL INFORMATION

Silage provides one of the most convenient, satisfactory, and palatable roughages available to Mississippi farmers. Its beneficial effect on the general thrift and health of the stock to which it is fed makes it popular with livestock producers.

Crops likely to be lost as the result of either frost or drouth can frequently be saved by ensiling.

The silo should be located and constructed with the idea of permanence and convenience. The walls must be impervious to air and moisture and must be strongly reinforced to resist the outward pressure exerted by the silage in settling. They should be smooth to permit even settling of the silage. The silo should be cylindrical in form as this construction permits of strongest reinforcement of wall and does not allow corners or pockets for the collection of air. The door frame should be perpendicular, strongly built and should allow no weakness in the reinforcement of the silo walls. It should also permit of air tight door fittings.

SIZE OF SILO NEEDED

The diameter of the silo, while it should be ample for needs, should be small enough to allow the feeding out of about three inches per day, otherwise spoilage will occur.

The following tabulation secured from Farmers' Bulletin 589 of the United States Department of Agriculture indicates the relation of the size of the herd to the diameter of the silo:

Inside Diameter of Silo	Quantity of Silage in Depth of 3 Inches	Number of Animals that may be fed, allowing		
		40 lb per Head	30 lb per Head	20 lb per Head
10	785	19	26	39
12	1131	28	37	56
14	1539	38	51	77
16	2011	50	67	108

The height of the silo should be at least twice the diameter as the taller the silo, the greater the capacity of each cubic foot of space contained. Other conditions the same, there is a larger percentage of waste in a shallow silo than in one that is deep.

In the survey just completed, the silo diameters ranged from twelve to sixteen feet and the heights from twenty-seven to forty-one feet. Of the twenty-five silos, eight were of concrete, three of tile, and fourteen of wood construction.

COST OF BUILDING SILOS

A survey made in 1914 by the Mississippi Experiment Station, cooperating with the United States Department of Agriculture, on seventy-five selected farms in the prairie and brown loam sections of the state provides the following data in regard to silos at that time.*

Number	Kind	Average Capacity	Cost of Construction per Ton Capacity
40	Stave	162 Tons	1.84
15	Concrete	195 "	2.23
1	Brick	180 "	1.80
2	Gurler	170 "	1.36
9	Underground	94 "	.94

Examination of the index figures on price trends would indicate that construction costs are at least eighty percent higher at this time than they were at the time of the building of the silos listed.

Underground or pit silos are only suited to localities where the soil is very firm and where the water table is down several feet.

The monolithic concrete silo seems to be gaining in popularity in the South. Where properly constructed, though the first cost is usually more than for the wood, they are more satisfactory than the less permanent types and the cost for each year of service is smaller. For concrete silos the sand used must be clean, otherwise the walls will not be impervious to moisture and the silage will not keep.

Tile and metal silos where not too expensive are generally satisfactory. Tile or brick silos like all others must be properly reinforced.

Wood silos will last from five to perhaps fifteen or twenty years, depending on the kind of wood and the care taken of them. They should be strongly anchored, kept well painted, and in the case of the ordinary stave silos the hoops must be kept tightened.

The silos should be conveniently located with regard to both filling and feeding. Space should be provided about the silo for placing of the engine and cutter and for getting the teams and loads to the machine without backing or sharp turning.

The doors of the silo should commence at the ground and should be close enough together to prevent the necessity of excessive lifting of the silage in feeding out.

Blue prints and specifications for the building of silos, as well

*Unpublished data collected by the late S. S. Jerdan.

as other information on silo construction, can be secured by writing to the Agricultural Engineering Department of the Mississippi A. & M. College.

Corn should be harvested for silage when the grains are dented and glazed and the leaves are still green, or the bottom leaves just commencing to turn brown. Where sorghum is used the seed should be well glazed.

Where corn has become dry, water must be run into the silo in order to secure proper packing. This can be accomplished best by running a hose from a barrel or tank into the blower and blowing the water up into the silo. Where the silage is very dry, enough water cannot be carried into the silo in this way and additional means should be employed. The cut corn or stover should be sufficiently moist to pack well on tramping.

The corn or sorghum should be cut into pieces one-half to one inch in length to permit of sufficient packing to exclude air.

The blower pipe should be as nearly perpendicular as possible.

During the filling operation the silage should be well mixed. The silage in the center should be kept rounded up and that around the walls should be thoroughly tramped to exclude air.

With slow filling, more silage is put into the silo because of the settling which takes place during the operation. The disadvantage of slow filling is increased costs.

Refilling is frequently practiced and in such instances any spoiled silage should be removed from the top before starting to fill the second time.

In silo filling there is the possiblity of danger from the formation of carbon dioxide gas. This can be avoided by leaving all doors open above the silage or in case of pit silos by lowering a lighted lantern into the pit before entering. If the light continues to burn there is no danger from this source. If the light is extinguished the gas in the silo may be driven out by setting up a circulation of air by letting the cutter run a few minutes before entering the silo.

There is always some spoiled silage at the top of the silo. Where the silage is properly packed this will probably not exceed one or two tons. Loss from this source may be reduced in the case of corn by removing the ears from the last few loads run into the silo. Straw or weeds are sometimes cut and run into the silo for the purpose of sealing the top. Two or three barrels of water poured over the top will assist in sealing. Oats are sometimes sowed over the top for the same purpose.

Texas seeded ribbon cane is one of the most common and valuable silage crops in Mississippi. Its yield is generally considerably greater and as a crop it is more dependable than corn. Its feeding value ranges from seventy-five to eighty-five percent of that of corn.

FEEDING

On opening the silo all spoiled silage at the top should be removed and the silage should be kept level at all times. Silage should not be thrown down from the silo and allowed to remain in piles to spoil between feeds. Spoiled silage should not be fed to any kind of animals. The feeding of spoiled silage to horses and sheep is especially dangerous. Even slight spoilage of silage may be detected by the moldy odor when a double handful is examined.

Silage gives best results when fed in connection with a small amount of some dry roughage. It is well suited to a ration in which cottonseed meal composes part of the concentrate portion. Because of the higher moisture content, about three times as much silage should be fed as would be fed of dry roughage.

The following silage rations recommended by the Animal Husbandry and Dairy Divisions of the Mississippi A. & M. College have proved satisfactory under Mississippi conditions:

For an eight hundred pound cow producing twenty-five pounds of four percent milk:

30 pounds Corn Silage
12 pounds Soybean or Lespedeza Hay
3 pounds Corn and Cob Meal
1 pound Cottonseed Meal

For wintering two-year old beef heifers and mature cows:

25 pounds Corn Silage
10 pounds low grade Johnson Grass Hay
1 pound Cottonseed Meal

For wintering yearling beef heifers:

25 pounds corn silage
8 pounds low grade Johnson Grass Hay
1.5 pounds Cottonseed Meal

For wintering beef calves:

15 pounds Corn Silage
5 pounds Johnson Grass Hay
1 pound Cottonseed Meal

For fattening two-year old steers:

40 pounds Corn Silage
3 pounds Johnson Grass Hay
5 to 7 pounds Cottonseed Meal

With the latter ration, care should be taken to bring the steers gradually up to a full feed of cottonseed meal. A very satisfactory rule to follow is to start with two pounds of cottonseed meal daily for each steer and increase one-half pound every second or third day until they are getting five pounds for each head per day. Further raises may be made in accordance with the increase in weight of the steers.

ESTIMATED WEIGHT OF SETTLED SILAGE

From Bulletin 164, Missouri Agricultural Experiment Station
By C. H. Eckles, Missouri Agricultural Experiment Station and
O. E. Reed and J. B. Fitch, Kansas Agricultural Experiment Station

Depth of Silage feet	Estimate weight of Silage to the Cubic Foot at This Depth	Average weight of Silage to the Cubic Foot to This Depth	10 Feet Diameter	12 Feet Diameter	14 Feet Diameter	16 Feet Diameter	18 Feet Diameter
	Lbs.	Lbs.	Tons	Tons	Tons	Tons	Tons
1	32.0	32.0	1.3	1.8	2.5	3.2	4.1
2	32.7	32.4	2.5	3.7	5.0	6.5	8.2
3	33.4	32.7	3.9	5.5	7.6	9.9	12.5
4	34.1	33.1	5.2	7.5	10.2	13.3	16.8
5	34.8	33.4	6.6	9.5	12.9	16.8	21.2
6	35.4	33.7	7.9	11.4	15.6	20.3	25.7
7	36.0	34.1	9.4	13.5	18.4	24.0	30.3
8	36.6	34.4	10.8	15.6	21.2	27.7	35.0
9	37.4	34.7	12.3	17.7	24.0	31.4	39.7
10	38.0	35.0	13.7	19.8	27.0	35.2	44.5
11	38.4	35.3	15.3	22.0	29.9	39.0	49.3
12	38.8	35.6	16.8	24.1	32.9	42.9	54.3
13	39.2	35.9	18.3	26.4	35.9	46.9	59.3
14	39.6	36.2	19.9	28.7	39.0	50.9	64.4
15	40.0	36.4	21.4	30.9	42.0	54.9	69.3
16	40.2	36.7	23.1	33.2	45.2	59.0	74.6
17	40.4	36.9	24.6	35.5	48.3	63.0	79.7
18	40.6	37.1	26.2	37.8	51.4	67.1	84.8
19	40.8	37.3	27.8	40.1	54.6	71.2	90.0
20	41.0	37.5	29.5	42.4	57.8	75.4	95.3
21	41.2	37.6	31.0	44.7	60.8	79.4	100.3
22	41.4	37.8	32.7	47.0	64.0	83.6	105.6
23	41.6	38.0	34.3	49.4	67.3	87.8	110.5
24	41.8	38.1	35.9	51.7	70.4	91.9	116.1
25	42.0	38.3	37.6	54.2	73.7	96.2	121.6
26	42.2	38.4	39.2	56.5	76.9	100.3	126.8
27	42.4	38.6	40.9	58.9	80.2	104.7	132.4
28	42.6	38.7	42.6	61.3	83.4	108.9	137.6
29	42.8	38.9	44.3	63.8	86.9	113.4	143.3
30	43.0	39.0	45.9	66.1	90.1	117.6	148.6
31			47.6	68.5	93.4	121.9	154.1
32			49.3	70.9	96.7	126.2	159.5
33			51.0	73.4	100.0	130.5	165.0
34			52.7	75.8	103.3	134.8	170.5
35			54.4	78.2	106.6	139.1	175.9
36			56.1	80.7	110.0	143.5	181.4
37			57.8	83.1	113.3	147.8	186.9
38			59.5	85.5	116.6	152.1	192.4
39			61.1	87.9	119.9	156.4	197.8
40			62.8	90.4	123.2	160.7	203.3

The table in Bulletin 164 of the Missouri Agricultural Experiment Station does not give the estimated weights of silage or capacities of silos below thirty feet, but the authors state that there is very slight increase in weight per cubic foot below this depth. The estimated capacities below thirty feet in depth are based on the weight of a cubic foot of silage at that depth.

The estimates in this table are based on Kansas and Missouri conditions. As the amount of grain and also the amount of moisture in the silage influence its weight, considerable variation may be expected from the figures given. Silage in Mississippi will usually contain less grain than that in Missouri and Kansas, which would mean a lowering of the capacities of the silos in this state.

Recommendations in Missouri Bulletin 164 in connection with this table are as follows:

1. When the corn is put into the silo in a less mature condition than usual, for example, in the milk stage, or at the beginning of the dough stage, add ten to fifteen percent to the weights given in the table.

2. If the grain is unusually heavy in proportion to the stalk, add five to ten percent to the figures as found by the table.

3. If the corn is considerably past the usual stage of maturity and clearly contains less water than usual, deduct ten to fifteen percent.

4. If very little or no grain is present, deduct ten percent.

Bulletin No. 230 December, 1925

INDEXED
Division of Horticulture Catalog

Cotton Experiments 1925

FERTILIZERS AND VARIETIES

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E. C. EWING ..... Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept. of Agr.
**On Leave of Absence.

COTTON EXPERIMENTS, 1925

FERTILIZERS AND VARIETIES

J. F. O'Kelly and W. W. Hull (1)

RECOMMENDATIONS

The results of fertilizer and variety experiments conducted by the Central Station, A. & M. College, and reported in this and previous publications seem to justify the following recommendations for cotton production in east central Mississippi.

Acid phosphate should be used on all soils of east central Mississippi which are considerably worn from much cropping. Even in the prairie section liberal quantities of acid phosphate will pay if accompanied by the right proportion of nitrogen. At present, results indicate that the right proportion is eight parts phosphoric acid to six parts nitrogen.

Nitrogen is needed by nearly all the soils of this section and should be used in the right proportion with acid phosphate, and potash if needed, for most profitable returns.

Where cotton rusts to any considerable extent year after year, the use of potash will be as certainly profitable as the use of any other fertilizer under any condition. Where cotton does not rust and only moderate quantities of other fertilizers are being used, the economy of potash application is questionable. Where more than 600 pounds to the acre of a mixture of acid phosphate and a nitrogen carrier is being used, the use of potash will very probably be profitable.

Therefore, it is desirable to use a mixture of 8 parts phosphoric acid, 6 parts nitrogen, and 4 parts potash where cotton rusts or where more than 600 pounds to the acre is being used. It is possible that the results of future experiments will justify an increase in the proportion of nitrogen.

A ready mixed fertilizer can be used provided the nitrogen is readily soluble or, the proper mixture can be approximated by mixing 400 pounds acid phosphate, 300 pounds nitrate of soda, and 65 pounds sulphate of potash. If ammonium sulphate is preferred, use 225 pounds instead of 300 pounds of nitrate of soda. If 12% kainit is the source of potash use 260 pounds instead of 65 pounds sulphate of potash.

Potash may be omitted from the mixture just recommended if cotton does not rust and a light application is being used.

The quantity of fertilizer used should, in nearly all cases, be 600 pounds or more to the acre. The rate to be used will be affected by the natural fertility of the soil, the previous fertilization practiced, and the preceding crops.

There are more than a half dozen well bred cotton varieties which are well adapted to east central Mississippi.

As a rule, the pounds of lint to the acre which a variety will produce should be given considerable weight in the selection of a variety. This will usually give preference to those varieties having a staple length of less than 1⅛ inch. However, if the grower's marketing system enables him

(1) Roland Cowart, now doing graduate work at the University of Illinois, assisted in collecting much of the data presented in this publication, particularly the results of co-operative fertilizer experiments.

to obtain an adequate premium for extra staple the growing of a staple variety on the more fertile soils of the hill section may be justified.

Vigorous growing varities should, as a rule, be chosen for thin hill lands. Dwarf varieties are seldom satisfactory on such soils except during wet seasons with heavy weevil infestation, the occurence of which no one can accurately predict. Dwarf varieties are best adapted to fertile bottoms where earliness is needed and stamina is not an important consideration. The reader is urged to give careful consideration to average results reported in table 4 as well as the tables which follow.

Table 1—Average results of tests in Oktibbeha County on station farm and fa of G. G. Wofford—1925

Pounds of material applied to the acre			Formula	Pounds Seed Cotton Per Acre		Dollars per Acre		
Acid Phos.	Nitrate of Soda	Sul. of Potash		Average	Increase	Increase at 7 cts.	Cost of Fertilizer	Net Gain
No fertilizer				534.0				
300	150	100	8-4-8	877.3	343.3	24.03	9.27	14.7
300	150	75	8-4-6	978.0	444.0	31.08	8.65	22.4
300	150	50	8-4-4	887.4	353.4	24.74	8.02	16.7
No fertilizer				534.0				
300	150	25	8-4-2	815.1	281.1	19.68	7.40	12.2
300	150	none	8-4-0	622.3	88.3	6.18	6.77	—.5
300	300	50	8-8-4	1009.6	475.6	33.29	12.14	21.1
No fertilizer				534.0				
300	225	50	8-6-4	967.3	433.3	30.33	10.08	20.2
225	150	50	6-4-4	870.8	336.8	23.58	7.36	16.2
150	150	50	4-4-4	791.0	257.0	17.99	6.70	11.2
No fertilizer				534.0				
600	300	100	8-4-4	1319.2	785.2	54.96	16.04	38.92
900	450	150	8-4-4	1318.1	784.1	54.89	24.06	30.8
1200	600	200	8-4-4	1262.2	728.2	50.97	32.08	18.8
No fertilizer				534.0				

NOTE—The materials applied to the last three fertilized plots supply approximately as much pl food to the acre as would be supplied by 1200, 1800 and 2400 pounds respectively, of 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertili of the formulas indicated.

Early in 1925 the experiment stations of Mississippi started a number of new cotton fertilizer tests on nearly all soil types of the state. These tests were planned to give more definite information as to the most profitable proportions and rates of cotton fertilizers. The results of these tests in Oktibbeha, Choctaw and Lowndes Counties together with the results of tests already under way at the Central Station are reported in the first part of this publication, the last part being devoted to comparisons of standard and new cotton varieties.

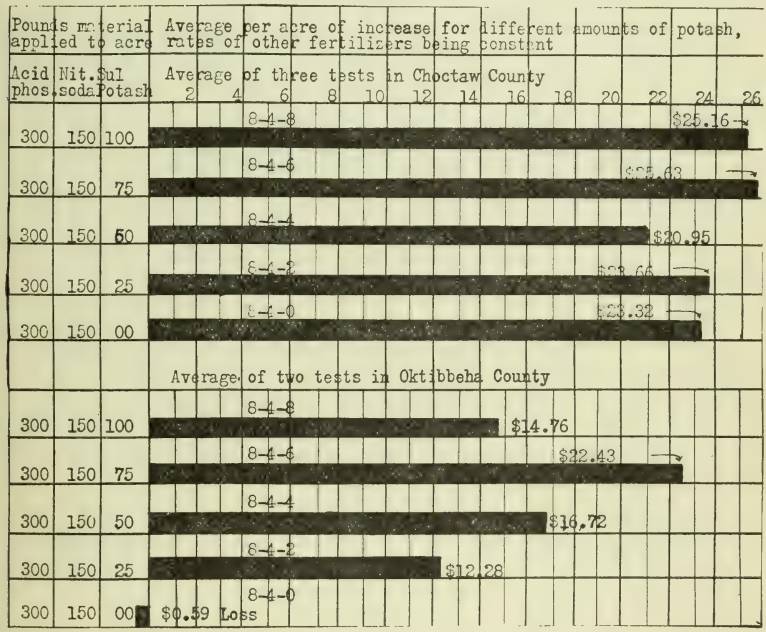
FERTILIZERS

The new experiments planned for the several soil types of the state include varying quantities of acid phosphate, nitrate of soda, sulphate of potash, and a complete fertilizer. That is, while acid phosphate and nitrate

of soda were applied at constant rates to several plots the rate of potash was varied. While the rate for nitrate of soda was being varied the other two fertilizers were applied at a uniform rate. The same was true in the case of acid phosphate. All the rates just mentioned were based on 600 pounds of mixed fertilizer to the acre. Then, a mixture analyzing approximately 8% phosphoric acid, 4% ammonia, and 4% potash was applied at the rate of 600, 1200, 1800 and 2400 pounds to the acre. A study of tables 1 and 2 will make this explanation better understood.

All fertilizers in all tests reported here were applied before planting and a member of the experiment station staff supervised the application of the fertilizers and picking in every case.

Cut 1


Pounds material applied to acre
Average per acre of increase for different amounts of potash, rates of other fertilizers being constant
Acid phos. Nit. soda Potash
Average of three tests in Choctaw County
2 4 6 8 10 12 14 16 18 20 22 24 26
300 150 100 8-4-8 $25.16
300 150 75 8-4-6
300 150 50 8-4-4 $20.95
300 150 25 8-4-2
300 150 00 8-4-0 $23.32
Average of two tests in Oktibbeha County
300 150 100 8-4-8 $14.76
300 150 75 8-4-6 $22.43
300 150 50 8-4-4 $16.72
300 150 25 8-4-2 $12.28
300 150 00 8-4-0 $0.59 Loss

Two of the experiments just described were successfully completed in Oktibbeha County and average results are reported in table 1. One of these tests was on the experiment station farm at A. & M. College. The soil is classed as Ocklocknee loam. The other test was on the farm of G. G. Wofford about nine miles northwest of Starkville. The soil is classed as Oktibbeha silt loam. Neither of these soils was originally extremely fertile and both have been considerably depleted thru cropping. Rust damage was moderate to severe in both tests.

The most outstanding feature of these Oktibbeha County tests is the results obtained from the use of potash. These potash results are given in table 1 and are presented graphically in the lower half of cut 1. It will be observed that except in one case, the value of the increase was less as the percentage of potash was lowered and that where no potash was used the value of the increase was not sufficient to pay for the other fertilizers used.

These results also indicate that the proportion eight parts phosphoric acid to four parts nitrogen is too low in nitrogen. It will be seen from table 1 and the lower half of cut 2 that equal parts phosphoric acid and

Table 2—Average results of tests in Choctaw County on farms of J. C. Cork, Clyde Coleman and J. B. Ray—1925

Pounds of material applied to the acre			Formula	Pounds Seed Cotton Per Acre		Dollars per Acre		
Acid Phos.	Nitrate of Soda	Sul. of Potash		Average	Increase	Increase at 7 cts.	Cost of Fertilizer	Net Gain
No fertilizer				843.6				
300	150	100	8-4-8	1335.5	491.9	34.43	9.27	25.16
300	150	75	8-4-6	1333.3	489.7	34.28	8.65	25.63
300	150	50	8-4-4	1257.4	413.8	28.97	8.02	20.95
No fertilizer				843.6				
300	150	25	8-4-2	1287.3	443.7	31.06	7.40	23.66
300	150	none	8-4-0	1273.5	429.9	30.09	6.77	23.32
300	300	50	8-8-4	1467.1	623.5	43.65	12.14	31.51
No fertilizer				843.6				
300	225	50	8-6-4	1551.7	708.1	49.57	10.08	39.49
225	150	50	6-4-4	1386.2	542.6	37.98	7.36	30.62
150	150	50	4-4-4	1297.7	454.1	31.79	6.70	25.09
No fertilizer				843.6				
No fertilizer				895.6				
600	300	100	8-4-4	1634.0	738.4	51.69	16.04	35.65
900	450	150	8-4-4	1838.2	942.6	65.98	24.06	41.92
1200	600	200	8-4-4	1916.3	1020.7	71.45	32.08	39.37
No fertilizer				895.6				

NOTE—The materials applied to the last three fertilized plots supply approximately as much plant food to the acre as would be supplied by 1200, 1800 and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.

nitrogen gave the greatest returns in these trials. Other tests indicate that a ratio of eight to six between phosphoric acid and nitrogen is most profitable. It is the opinion of the writers that the proportion of nitrogen should not be lower than the latter.

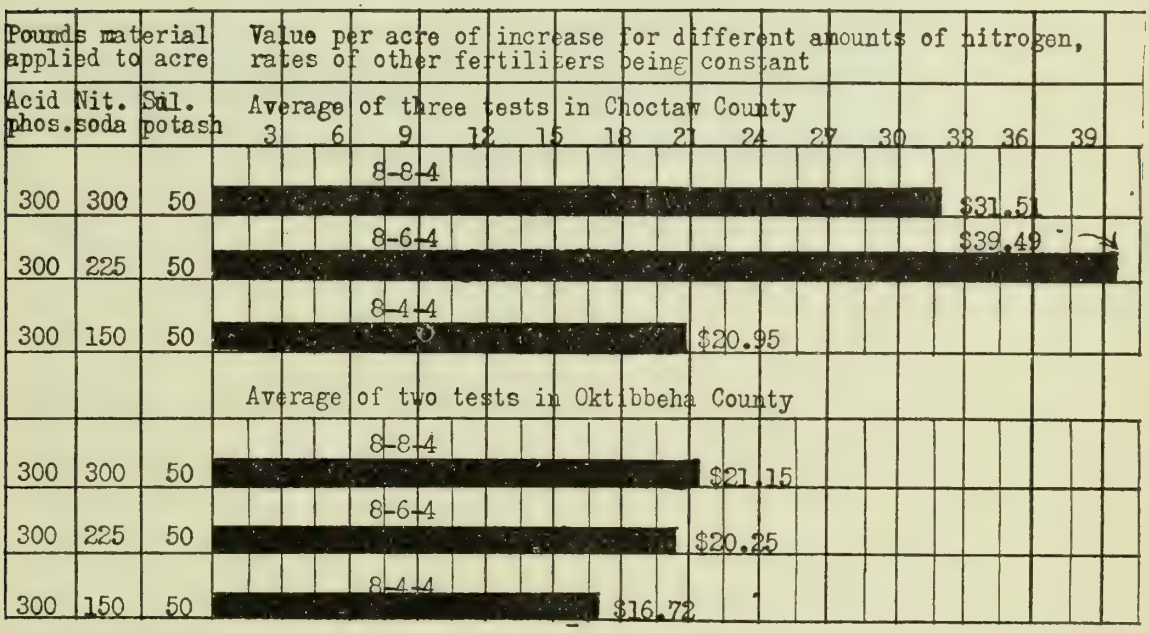
The gains obtained from the use of phosphoric acid were more consistent than usual. With an increasing percentage of this material the net profits increased slightly.

An 8-4-4 mixture when used at the rate of 1200 pounds to the acre gave a greater net value than when used in smaller or greater quantities. During the very severe drouth the thrifty condition of the plants on heavily fertilized plots presented a very decided contrast with those on plots receiving little or no fertilizer.

Three experiments were completed in Choctaw County similar to those reported for Oktibbeha County. The first was on the farm of J. C. Cork south of Ackerman, the second on the farm of Clyde Coleman east of Weir, and the third on the farm of J. B. Ray northwest of Weir. The soil on all of these farms is typical of the sandy soils of the short leaf pine area. Average results of these three tests are given in table 2.

In these Choctaw County tests no appreciable amount of rust was evident during the growing season and the results from the use of potash contrast markedly with those obtained from similar tests in Oktibbeha County where rust was moderate to severe. It will be seen from a study of table 2 and the first half of cut 1 that the value of 600 pounds of fertilizer was not materially improved by the addition of potash.

Cut 2

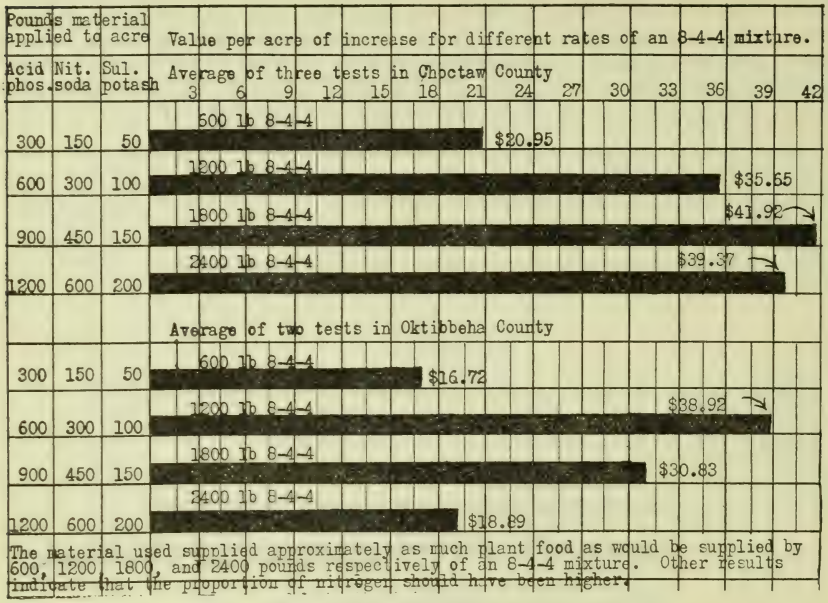


All three Choctaw County tests indicated that 6% nitrogen is more profitable than either 8% or 4%. Ultimately, it may be proved that equal parts of nitrogen and phosphoric acid should be used. At present it seems safe to conclude that there should be at least 6 parts nitrogen to 8 parts phosphoric acid. Cut 2 presents the nitrogen results from the tests in the two counties.

When the rate per acre of an 8-4-4 mixture was varied 1800 pounds to the acre gave a greater net return than any other rate and 2400 pounds gave a greater net return than 1200 pounds. It is entirely possible that future trials will indicate that 800 to 1200 pounds to the acre of the right mixture is not only safe and profitable but also a necessity on all of the thin soils of east central Mississippi.

For some time many have believed that nitrogen is profitable when used in cotton production in the prairie section of Mississippi but many have doubted the wisdom of the use of phosphoric acid and potash. With the object of establishing a basis from which to work the experiment station planned a simple test for the prairie soils. The nature of this test can be

Cut 3


Pounds material applied to acre
Acid phos.
Nit. soda
Sul. potash
Value per acre of increase for different rates of an 8-4-4 mixture.
Average of three tests in Choctaw County
3 6 9 12 15 18 21 24 27 30 33 36 39 42
300 150 50
600 lb 8-4-4
$20.95
600 300 100
1200 lb 8-4-4
$35.55
900 450 150
1800 lb 8-4-4
$41.92
1200 600 200
2400 lb 8-4-4
$39.37
Average of two tests in Oktibbeha County
300 150 50
600 lb 8-4-4
$16.72
600 300 100
1200 lb 8-4-4
$38.92
900 450 150
1800 lb 8-4-4
$30.83
1200 600 200
2400 lb 8-4-4
$18.89
The material used supplied approximately as much plant food as would be supplied by 600, 1200, 1800, and 2400 pounds respectively of an 8-4-4 mixture. Other results indicate that the proportion of nitrogen should have been higher.

learned from table 3. The object was simply to determine whether phosphoric acid and potash when used with nitrate of soda would pay, not to determine what rates would be most profitable. For this reason the rates were much heavier than have been customary in most experimental work.

Table 3—Average results of tests in Lowndes County on farms of J. H. Hardy and Carey Cocke—1925

Pounds of material applied to the acre			Pounds Seed Cotton Per Acre		Dollars per Acre		
Acid Phos.	Nitrate of Soda	Sul. of Potash	Average	Increase	Increase at 7 cts.	Cost of Fertilizer	Net Gain
No fertilizer			1048.2				
	300		1175.6	127.4	8.92	8.25	0.67
600	300	75	1425.3	377.1	26.40	15.41	10.99
No fertilizer			1048.2				
600	300		1331.6	283.4	19.84	13.53	6.31
	300	75	1255.1	206.9	14.48	10.13	4.35
No fertilizer			1048.2				

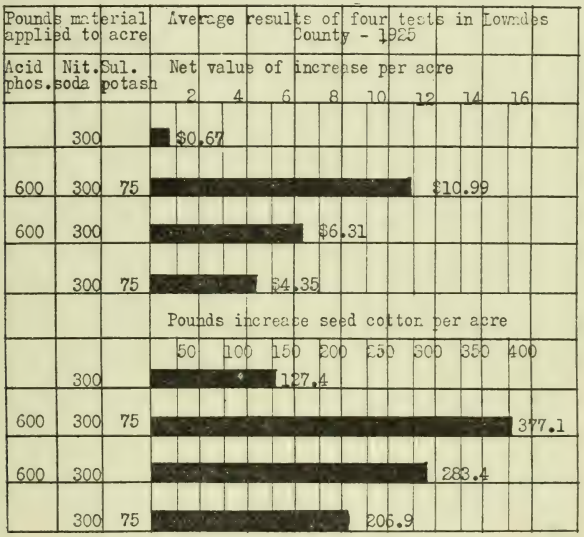
Four of these tests were completed in Lowndes County. Two were on black land and two were on typical red post oak soil. J. H. Hardy and Carey Cocke cooperated in this work, each having two tests. All four tests were averaged to make the results more accurate.

From a study of table 3 and cut 4 it will be observed that 300 pounds nitrate of soda used alone gave an increase of only 127.4 pounds seed cotton to the acre which, after the cost was deducted, left a net value of

only 67 cents to the acre. This is disappointing and is very probably much lower than can ordinarily be expected. It is possible too that a smaller quantity of soda would have done as well when used alone thus saving the cost of the excess nitrogen to be added to the net value per acre.

While a few farmers have for some time used acid phosphate in the prairie section with apparent profit a great many experiments with this material have given negligible and often negative results. This failure to obtain consistent gains from the use of phosphate on the lime soils of the prairie section has sometimes been explained by saying that these soils were able to supply all the phosphorus the plant needed. Others have maintained that, altho these soils might be deficient in phosphorus, applications of this material were seized by the lime and held in a form unavail-

Cut 4



able to the plant. The first of these explanations has been exploded and the second deserves less consideration than has been given it. Four tests on prairie soils varying from thin red post oak to fertile black bottoms showed consistent increases from the use of a liberal application of acid phosphate when balanced with a reasonable proportion of nitrogen.

What has been said elsewhere about the use of potash in other sections of the state can be repeated here for the prairie soils. Where cotton rusts or where more than 600 pounds of fertilizer is being used on an acre use 50 pounds or more of sulphate of potash to the acre. Where cotton does not rust and less than 600 pounds to the acre of other fertilizer is being used potash probably will not be profitable.

During the season just past a comparison between sulphate of potash and kainit for rust control was made on the experiment station farm. The net value of the increase produced by 50 pounds sulphate of potash was $24.00 per acre and that produced by 200 pounds kainit was $23.00 per

acre. Since this is only one test the difference may be attributed to error and these potash carriers may be considered equally efficient. So far as is known muriate of potash is as efficient as the two carriers just discussed.

VARIETIES

Variety experiments covered trials with 45 standard and new varieties during the season of 1925. These tests included a test of standard varieties, one of standard and new varieties, and a test for wilt resistant varieties. Several varieties were included in more than one test.

Table 4—Nine types of cotton at the Central Station

Year	POUNDS LINT COTTON PER ACRE								
	Half & Half	Cook	Cleve. 54	Cleve. Wan.	Cleve. Pied.	Salsbury	Trice	Miller	Delfos
1921	589.1	555.0	552.9	554.1	571.3	425.6	470.3	497.3	443.2
1922	299.1	334.2	315.6	249.8	302.7	257.3	279.0	320.3	262.8
1923	321.3	303.5	344.4	251.6	348.3	285.1	396.5	323.8	368.9
1924	369.9	397.6	397.6	379.5	394.6	342.9	337.6	377.9	306.9
1925	629.5	613.2	615.4	553.3	557.0	520.5	461.3	597.3	460.6
Av. lb.	441.8	440.7	445.2	397.7	434.8	366.3	388.9	423.3	368.5
Av. value	$103.79	$107.69	$114.73	$ 97.79	$112.36	$110.62	$116.31	$119.24	$117.17
Av. length	3-4 s	7-8 s	15-16	7-8 s	15-16 s	1 1-8 s	1 1-16	1 1-16	1 3-16s
Av. p'c'tage	42.6	39.0	35.4	37.6	35.0	33.1	31.7	34.3	32.4

The growing season was even drier than in 1924. Many readers will not need to be cautioned against giving too much weight to variety results covering one year only but, for the benefit of others, it may be well to repeat this warning especially after a season so abnormal in its effects on cotton production as the one just past.

Five year average results for several varieties are presented in table 4. This is probably the most dependable guide for the choice of a variety in east Mississippi. Willis and D. & P. L. No. 4 are not included in this table because they have not been in the station tests for five years. While comparing these and other varieties with those in the five year average the reader should bear in mind that the past year was exceedingly dry while the five year average includes two very dry seasons (1924 and 1925) one very wet season (1923) and two nearly normal seasons (1921 and 1922).

Doubtless, during the last two seasons many late varieties and mixtures have done extremely well. At the same time many very early varieties have not fulfilled expectations. While very late varieties are not dependable

under weevil conditions, it must be admitted that extreme earliness may be emphasized too strongly. Results indicate that in the hills of Mississippi and for average conditions one should choose a vigorous growing variety which at the same time has considerable earliness and prolificacy.

Table 5—Standard varieties—1925

Variety	Pounds per Acre		Lint Data			Total Dollars per Acre	Rank in Value	Bolls per lb.
	Seed Cotton	Lint	Per-cent-age	Length	Cents per lb.			
Trice, Miss. Sta.	1450.6	461.3	31.8	1 1-16	20.83	115.88	21	90
Trice, Burdette	1293.2	411.2	31.8	1 1-16	20.83	103.29	22	85
Cleveland, Wan.	1483.5	553.3	37.3	7-8	18.00	118.19	20	82
Cleveland, Pied.	1623.8	557.0	34.3	7-8	18.00	121.60	16	81
Cleveland, Coker	1494.5	557.4	37.3	7-8 f	18.33	120.91	17	77
Cleveland, 54	1738.5	615.4	35.4	15-16	18.53	136.49	7	80
Half & Half, Sum.	1383.5	629.5	45.5	3-4 f	16.80	120.84	18	76
Cook 1010	1514.0	613.2	40.5	13-16	17.10	122.88	14	85
Willis	1593.3	549.7	34.5	15-16 f	18.83	124.38	11	77
Miller	1716.5	597.3	34.8	1 1-16	20.83	146.80	4	62
Acala	1475.0	531.0	36.0	1 f	19.75	123.75	12	70
Mex. Big Boll	1520.1	532.0	35.0	1 1-16	20.83	130.58	8	68
D. & P. L. No. 4	1636.0	628.2	38.4	1 1-16 f	21.25	153.65	2	78
Lone Star 65	1416.4	492.9	34.8	1 1-16 f	21.25	123.21	13	68
Salsbury	1544.5	520.5	33.7	1 1-8	22.50	137.59	6	88
Webber, Deltatype	1365.2	401.4	29.4	1 5-16	32.00	147.73	3	79
Delfos 631	1406.7	455.8	32.4	1 3-16 f	26.42	139.44	5	76
Delfos 911	1407.9	456.2	32.4	1 1-8 f	23.67	127.01	10	89
Delfos 6102	1395.7	460.6	33.0	1 1-8	22.50	122.34	15	89
D. & P. L. No. 5	1464.0	491.9	33.6	1 1-4 f	29.67	165.39	1	78
Express, Light.	1289.5	399.7	31.0	1 3-16	25.33	119.04	19	87
Express, 432	1376.2	470.7	34.2	1 1-8 f	23.67	129.52	9	92

The value per acre of any given variety was based on $40.00 a ton for seed and prices for lint based on an average of quotations as of November 2 middling grade obtained from Columbus, Memphis, and the State Farm Bureau at Jackson.

Variety tests reported here were planted between April 15 and April 20 but did not germinate until after the rains of May 9.

The last page of this publication gives the sources of the varieties used in these tests.

Table 5 reports the results from a test of twenty-two varieties, all of which are grown in commercial quantities. There were six replications of this test on soil shading from sandy loam to Houston clay. The fertilizer used was a light dressing of stable manure. The variations in stand were not considered sufficient to affect the accuracy of the results.

Table 6 reports results of twenty-three varieties some of which are standard commercial varieties while the others are comparatively recent introductions. There were six replications on Houston clay soil slightly mixed with sand. Drouth conditions were unusually severe on this test. Growth was terminated long before the fruiting season was over. The severity of the drouth is best indicated by the large number of bolls re-

quired to make a pound. The boll sizes in all tests were small but were worst in this and the wilt test.

Table 6—Standard and new varieties—1925

Variety	Pounds per Acre		Lint Data			Total Dollars per Acre	Rank in Value	Bolls per lb.
	Seed Cotton	Lint	Per-centage	Length	Cents per lb.			
Trice, Miss. Sta.	793.0	259.3	32.7	1 f	19.75	61.88	22	111
Half & Half, Mahon	744.2	325.2	43.7	3-4	16.50	62.04	21	94
Half & Half, Sum.	762.5	356.9	46.8	3-4 f	16.80	68.07	15	97
Half & Half, Clev.	822.3	372.5	45.3	3-4 f	16.80	71.58	13	90
Half & Half, Lee	763.7	357.4	46.8	3-4	16.50	67.10	17	94
Morrow's Best	832.0	292.9	35.2	7-8	18.00	63.50	20	99
Cook 1010, Maul.	679.5	288.1	42.4	13-16	17.10	57.10	23	108
Kelly Big Boll	1098.0	422.7	38.5	15-16 f	18.83	93.10	4	85
Sol. & Oates B. B.	1061.4	402.3	37.9	1	19.33	90.94	5	72
Clev. T. M. Wan.	845.5	328.1	38.8	13-16 f	17.33	67.21	16	91
Clev., Coker, Str. 4	869.9	325.3	37.4	7-8	18.00	69.44	14	95
Clev. 54	952.8	346.8	36.8	7-8 f	18.33	75.69	11	90
Clev. 9, Coker	908.9	322.7	35.5	1 1-16 f	21.25	80.29	8	85
Clev., Collins	838.1	298.4	35.6	7-8 f	18.33	65.49	19	109
Addison's Pro.	832.0	332.0	39.9	13-16	17.10	66.77	18	98
Sikes B. B.	969.9	367.6	37.9	7-8	18.00	78.22	10	92
Mex. B. B. Wake Co.	917.4	330.3	36.0	1	19.33	75.59	12	78
Delfos 6102	889.4	297.1	33.4	1 1-8	22.50	78.70	9	109
D. & P. L. No. 6	929.6	340.2	36.6	1 1-8	22.50	88.34	6	108
D. & P. L. No. 7	1096.8	411.3	37.5	1 1-16 f	21.25	101.11	1	90
D. & P. L. No. 8	1046.8	426.0	40.7	1	19.33	94.77	2	95
Webber 49-101-3-3	916.2	323.4	35.3	1 1-8	22.50	84.63	7	112
Deltatype, Str. 3	941.8	286.3	30.4	1 1-4	28.33	94.22	3	91

Table 7—Test for wilt resistance—1925

Variety	Pounds per Acre		Lint Data			Total Dollars per Acre	Rank in Value	Bolls per lb.
	Seed Cotton	Lint	Per-centage	Length	Cents per lb.			
Trice, Miss. Sta.	304	100.6	33.1	1 f	19.75	23.94	14	130
Half & Half, Sum.	324	140.9	43.5	3-4 f	16.80	27.33	10	93
Cook 1010	322	131.1	40.7	13-16 f	17.33	26.54	11	111
Cook 307-6	346	121.1	35.0	13-16 f	17.33	25.49	13	112
Cook, Rhyne	420	155.8	37.1	13-16 f	17.33	32.28	7	89
Sol. & Oates B. B.	486	173.5	35.7	1	19.33	39.79	3	83
Dixie Triumph	380	136.8	36.0	15-16	18.53	30.21	9	106
Kelly B. B.	498	181.3	36.4	7-8 f	18.33	39.56	4	93
Cleveland 54	416	143.9	34.6	7-8 f	18.33	31.82	8	92
Miller	690	229.1	33.2	1 f	19.75	54.47	1	68
Salsbury	422	135.5	32.1	1 1-16	20.83	33.95	6	102
Delfos 6102	410	127.5	31.1	1 1-8 f	23.67	35.83	5	119
Express 432	312	100.5	32.2	1 1-16 f	21.25	25.59	12	106
Watson	506	165.5	32.7	1 1-8	22.50	44.05	2	95

The test for wilt resistance is reported in table 7. The soil used was inoculated with the wilt fungus *Fusarium vasinfectum* a few days before planting. Aside from wilt injury to susceptible varieties, fruiting in the entire test was terminated before the rains the latter part of July and the plants never recovered sufficiently to set more fruit than could be taken care of by the few weevils which by that time had appeared.

The varieties ranking first, second, third, and fourth in money value have considerable wilt resistance and to this group should be added Rhyne's Cook, Cook 307-6, and Dixie Triumph. Cleveland 54 and Salsbury are somewhat resistant while Trice, Half & Half, Cook 1010 and Delfos are moderately to highly susceptible.

SEED SOURCES

Acala—L. E. Gleeck, Box 334, Memphis, Tenn.
Addison's Pro.—W. P. Addison, Blackwells, Ga.
Cleveland, Coker—Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Coker, Str. 4—Pedigreed Seed Co., Hartsville, S. C.
Cleveland 9, Coker—Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Collins—Rock Mountain Pedigreed Seed Farms, Rome, Ga.
Cleveland, Pied.—Piedmont Pedigreed Seed Farms, Commerce Ga.
Cleveland, T. M. Wan.—T. M. Wannamaker, St. Matthews, S. C.
Cleveland, Wan.—Wannamaker-Cleveland Seed Farms, St. Matthews, S. C.
Cleveland 54—Miss. Exp. Sta., A. & M. College, Miss.
Cook, Rhyne—Rhyne Bros., Benton, Ala.
Cook, 307-6—Alabama Experiment Station, Auburn, Ala.
Cook 1010—D. N. Williamson Estate, Cedar Bluff, Ala.
Cook, 1010, Maul.—C. M. Mauldin, Route 1, Vincent, Ala.
D. & P. L. No. 4—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 5—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 6—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 7—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 8—Delta and Pine Land Co., Scott, Miss.
Delfos 631—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 6102—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 911—Delta Branch Experiment Station, Stoneville, Miss.
Dixie Triumph—L. O. Watson, Florence, S. C.
Express, Lightning—Pedigreed Seed Co., Hartsville, S. C.
Express 432—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Half & Half, Clev.—N. E. Cleveland, Stratton, Miss.
Half & Half, Lee—M. B. Lee, Corinth, Miss.
Half & Half, Mahon—H. K. Mahon, Holly Springs, Miss.
Half & Half, Sum.—B. F. Summerour, Norcross, Ga.
Kelly B. B.—S. O. Kelly, Headland, Ala.
Lone Star 65—Miss. Exp. Sta., A. & M. College, Miss.
Mex. Big Boll—Edgecombe Seed Breeders Assn., Tarboro, N. C.
Mex. Big Boll, Wake Co.—Wake County Seed Co., Raleigh, N. C.
Miller—Miss. Exp. Sta., A. & M. College, Miss.
Morrow's Best—J. N. Morrow, Aliceville, Ala.
Salsbury—Delta and Pine Land Co., Scott, Miss.
Sikes Big Boll—Sikes Seed Co., Box 244, Atlanta, Ga.
Sol. & Oates B. B.—Solomon and Oates, Headland, Ala.
Trice, Burdette—Burdette Plantation, Burdette, Ark.
Trice, Miss. Sta.—Miss. Experiment Station, A. & M. College, Miss.
Watson—L. O. Watson, Florence, S. C.
Webber, Deltatype—Pedigreed Seed Co., Hartsville, S. C.
Webber, Deltatype, Str. 3—Pedigreed Seed Co., Hartsville, S. C.
Webber 49-101-3-3—Pedigreed Seed Co., Hartsville, S. C.
Willis—Mrs. Stark Willis, Graysport, Miss.

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Report Raymond Branch Experiment Station 1925

By

H. F. WALLACE and C. B. ANDERS

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

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M. H. MOORE.....Secretary and Business Manager
J. R. RICKS, M. Sc.....Director and Chief in Agronomy
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D. MAXWELL.....Foreman and Herdsman
MISS MARY ALICE LANIER.....Addressograph Operator
H. B. BROWN, Ph. D.....Collaborator
E. C. EWING, M. Sc.....Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept of Agr.
....**On leave.

Report of the Work at the Raymond Branch Experiment Station

By H. F. Wallace
and
C. B. Anders

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year of 1925. Two other publications cover the results obtained by this Station since its establishment by an act of the Legislature of 1920. These publications may be secured from the Mississippi Experiment Station, A. & M. College, Mississippi, upon request.

Our results this past year were derived from experiments expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area of Mississippi. Very unfortunately a change was made in the management of this Station between planting and the harvest and it will be practically impossible to go into detail as to the cultural methods used in producing the 1925 crop.

The Divine will was that Mississippi be blessed with a bountiful cotton crop this past season. Dry growing periods practically controlled the boll weevil in 1924 and when it met the same conditions in 1925, its ranks were greatly depleted, but not to the extent to make us believe that the 1926 crop will be immune to its ravages.

Man's efforts in producing the 1925 harvest were justly rewarded. All credit to the success of the past season's work on this Station is due the former director, Mr. C. B. Anders and his able assistant, Mr. J. C. Peyton.

COTTON

The year of 1925 has been a wonderful cotton year. Mississippi has produced the largest cotton crop in her history. The average yield per acre this year in Mississippi is higher than any cotton growing state except three irrigated states of the west. Cotton has been made more cheaply this year due to the dry growing season and the absence of the boll weevil.

Varieties—A table follows in which twenty-five leading varieties of cotton are listed. Taking into consideration the work of the past year and the data of preceding years, we recommend for good valley land, Miss. Sta. Trice, Lone Star 65, Delfos, D & P L No. 4, Cleveland

54, and Miller; for hill land, Miss. Sta. Trice, Willis, Cleveland 54, Acala, and Miller.

Fertilizers—It is interesting to note in table II that every fertilizer combination used produced a profit. These fertilizers were home mixed and put down at the rate of from 600 to 2400 pounds of a corresponding commercial fertilizer per acre in three different localities. One of the cooperative tests was put on the farm of Mr. J. W. Hayes at Harperville, in Scott County. Mr. A. E. Terry, County Agent, as well as Mr. Hayes contributed every effort to the success of this test. The other was on the farm of Mr. George W. Harris of Rankin County and excellent cooperation was obtained.

These tests, as well as the test on the Station, were conducted in three series each, except the Scott County plots which were in two series. The table contains the results in condensed form.

In making recommendations, we can see a little advantage in increasing the quantity of nitrogen. A fertilizer for general use might be suggested as follows: 300 pounds acid phosphate, 200 pounds nitrate of soda, and 100 pounds of kainit per acre. One hundred pounds of nitrate of soda per acre used as a side dressing after chopping will probably prove beneficial when the boll weevil is present.

TABLE I—VARIETY TEST WITH COTTON—1925—RAYMOND STATION

Variety	Pounds per acre		Lint Data			Total dollars per acre	Rank in value
	Seed	Lint	Per-centage	Length	Cents per lb.		
Trice, Miss. Sta.	1641.0	696.6	29.8	1 1-16	20.83	177.92	14
Trice, Burdette	1529.8	655.6	30.0	1 1-16 f	21.25	169.91	20
Cleveland, Wan.	1436.5	854.5	37.3	7-8	18.00	182.54	9
Cleveland, Pied.	1586.3	770.7	32.7	15-16	18.53	174.54	15
Cleveland, Coker	1442.6	794.0	35.5	15-16 f	18.83	181.24	12
Cleveland 54	1603.6	811.4	33.6	1 f	19.75	192.32	8
Half & Half	1129.5	838.3	42.6	7-8	18.00	173.48	17
Cook 1010	1164.2	741.2	38.9	7-8 f	18.33	159.15	25
Willis	1535.2	739.2	32.5	1	19.33	173.59	16
Miller	1488.7	729.9	32.9	1 1-16	20.83	181.81	10
Acala	1328.4	702.8	34.6	1 1-16	20.83	172.96	19
Mex. Big Boll	1380.1	682.9	33.1	1 1-16	20.83	169.85	21
D. & P. L. No. 4	1456.1	815.5	35.9	1 1-16	20.83	198.99	6
Lone Star 65	1433.7	706.1	33.0	1 1-8 f	23.67	195.81	7
Salsbury	1448.8	678.6	31.9	1 1-16f	21.25	173.18	18
Webber, Deltatype	1450.9	639.7	30.6	1 5-16	32.00	233.72	1
Delfos 631	1535.4	709.4	31.6	1 3-16 f	26.42	218.13	3
Delfos 911	1457.6	698.6	32.4	1 3-16	25.33	206.11	5
Delfos 6102	1481.7	697.3	32.0	1 3-16	25.33	206.26	4
D. & P. L. No. 5	1377.2	654.0	32.2	1 1-4	28.33	218.82	2
Express, Light.	1416.3	604.1	29.9	1 3-16	25.33	181.34	11
Express, 432	1226.0	598.4	32.8	1 1-8 f	23.67	166.16	22
Gary	1340.7	777.3	36.7	1 f	19.75	180.33	13
Mahon's Half & Half	1080.4	776.0	41.8	7-8	18.00	161.29	24
Titche's Imp.	1399.5	756.9	35.1	7-8	18.00	164.23	23

TABLE II—AVERAGE THREE COTTON FERTILIZER TESTS, RAYMOND STATION, 1925.

Pounds of Material Applied to the Acre			Formula	Pounds Seed Cotton Test					Dollars per acre		
Acid Phosphate	Nitrate of soda	Sulphate of Potash	as Mixed Fertilizer	Station	J. W. Hayes	G. C. Harris	Average	Increase	Value	Cost fertilizer	Net Gain
No fertilizer				1465.0	898.6	486.4	950.0				
300	150	100	8-4-8	1838.6	1402.3	536.7	1259.2	309.2	21.64	9.27	12.37
300	150	75	8-4-6	1719.6	1185.4	506.2	1137.1	187.1	13.10	8.65	4.45
300	150	50	8-4-4	1689.3	1234.4	618.1	1180.6	230.6	16.14	8.02	8.12
No fertilizer				1465.0	898.6	486.4	950.0				
300	150	25	8-4-2	1776.2	1208.0	682.0	1222.1	272.1	19.05	7.40	11.65
300	150	None	8-4-0	1816.0	975.7	661.8	1151.2	201.2	14.08	6.77	7.31
300	300	50	8-8-4	1958.4	1164.0	1042.0	1388.1	438.1	30.67	12.14	18.53
No fertilizer				1465.0	898.6	486.4	950.0				
300	225	50	8-6-4	1928.8	1193.2	883.2	1335.1	385.1	26.96	10.08	16.88
225	150	50	6-4-4	1974.8	1071.9	851.6	1299.4	349.4	24.46	7.36	17.10
150	150	50	4-4-4	1767.6	1337.4	875.0	1326.7	376.7	26.37	6.70	19.67
No fertilizer				1465.0	898.6	486.4	950.0				
600	300	100	8-4-4	2102.6	1329.3	1099.1	1510.3	560.3	39.22	16.04	23.18
900	450	150	8-4-4	2292.7	1304.3	1064.7	1553.9	603.9	42.27	24.06	18.21
1200	600	200	8-4-4	2205.5	1552.8	944.6	1567.6	617.6	43.23	32.08	11.15
No fertilizer				1465.0	898.6	486.4	950.0				

Note:— The materials applied to the last three fertilized plots supply as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.

TABLE III—NITROGEN SOURCES TEST—1925

Pounds of material applied to the acre	Pounds seed cotton per acre		Percent increase	Dollars increase in value at 7 cts.
	Yield	Increase		
No Fertilizer	1482.5			
150 Nitrate soda	1801.9	319.4	21.54	22.36
112.5 Ammonium sulphate	1753.1	270.6	18.25	18.94
88 Ammonium nitrate	1845.1	362.6	24.46	25.38
No fertilizer	1482.5			
105 Calcium cyanamid	1827.5	345.0	23.27	24.15
173 Calcium nitrate	1804.5	322.0	21.72	22.54
48.9 Urea	1847.5	365.0	24.62	25.55
No fertilizer	1482.5			

Note: A general application of 300 pounds of acid phosphate and 150 pounds of sulphate of potash per acre was made to each plot, including the checks. Each nitrogen carrier was equivalent to 200 pounds of nitrate of soda, supplying 22.5 pounds of available nitrogen per acre.

Remarks—This is the first year that this test has been conducted at this station so we are unable to make any recommendations. The primary object of this test is to determine the cheapest nitrogenous fertilizer for the cotton grower.

Conclusions—One year's results are not considered final in experimental work. The table is published for your observation.

TABLE IV—SPACING TEST WITH COTTON—1925

Number of stalks		Yield in seed cotton per acre	Rank in production
Plot	Foot		
552	1.08	1736.6	5
902	1.77	1817.1	4
1146	2.25	1906.2	2
1445	2.83	1924.7	1
1511	2.96	1861.7	3

Remarks—The above test was planted in three series of two rows each on May 14, 1925. On March 5, 1925, a mixture of 300 pounds of acid phosphate, 200 pounds of nitrate of soda, and 200 pounds of kainit was applied per acre. Lone Star 65 cotton was used.

It was the intention to leave one, two, three, four, and five stalks respectively, per foot in this test, but an actual count reveals the exact number of stalks left.

Conclusions—From the above table and our results in the past, we do not hesitate to recommend three to five stalks per foot on hill land and two to three stalks per foot on valley land using three foot rows on the hill land and 3½ foot rows on the valley land. During an extreme dry year the best results will be secured from the medium of these recommendations, but an average year it appears they will hold good.

TIME OF APPLICATION OF FERTILIZER WITH COTTON—1925

It seems that some doubt has arisen in the minds of some as to the proper time to apply the various fertilizers. A test was conducted on this station the past year to determine the time of application. Extreme dry weather was a great hindrance to the late applications, but where acid phosphate was held out and applied in the sweep-furrow June 18 and the nitrogen and potash applied before planting, a difference of $28.64 in profit per acre was had in favor of applying the complete fertilizer before planting. Where all the fertilizer was applied at dirting, the profit was decreased $4.29.

Probably due to the dry season, these results are not pronounced as they might have been a normal year. Our results in the past indicate better yields when all fertilizer is applied before planting, except in cases of heavy infestation of coco, Bermuda or Johnson grass and should this situation occur it might be well to apply the nitrogen after the chopping has been completed. It is probable that additional yields might be obtained when from one to two hundred pounds of an available nitrogenous fertilizer per acre is used as a side dressing in addition to the amount put down at planting.

Lone Star 65 cotton was planted in this test, May 14, 1925. Three series were used.

CORN

During the past year quite a bit of attention was given to corn. Various tests including a variety test of seventeen leading varieties, a general fertilizer test, and a source of nitrogen test were conducted. The results of the variety test are given in table V.

In the general fertilizer test, an increase in nitrogen to 6 per cent gave the best results. Some potash seems to be beneficial. To get the best results from the nitrogen it will also be necessary to use some phosphorus. Where corn follows a trucking crop using heavy quantities of phosphorus and potash, it is doubtful as to whether anything but nitrogen is needed. In all cases in this section corn should be planted on the best land on the farm.

A suggested general fertilizer for corn in this section is 100 pounds of acid phosphate, 150 to 200 pounds of nitrate of soda, and about 50 pounds of kainit to the acre.

The source of nitrogen test has not been conducted long enough to make recommendations but lime nitrate gave promising results during the past year.

TABLE V—CORN VARIETY TEST—1925

Variety	Yield bus. shelled corn per acre	Per cent of grain	Rank	Average 1922 to 1925	Average in rank
Mosby, Station	40.66	79.0	5	27.69	8
Mosby, Delta	39.10	78.1	8	28.46	5
Mosby, Lee	38.04	80.0	11	——	——
Mosby, Suttle	37.29	81.4	13	——	——
Cocke's Prol., Sta.	40.86	77.7	4	29.36	3
Cocke's Prol., Delta	39.77	78.4	7	27.95	7
Hastings	37.94	75.7	12	26.56	9
Delta Prolific	36.93	76.2	14	26.39	10
Johnson Prolific	38.25	77.6	10	——	——
Laguna	41.49	74.7	2	31.66	1
Mexican June	38.81	75.8	9	——	——
Paymaster	40.96	81.2	3	28.18	6
Ellis	40.31	76.8	6	28.63	4
Yellow Dent, Ferg.	36.05	77.6	15	——	——
Yellow Dent, Sta.	35.07	76.9	16	——	——
Golden Dent	32.36	76.7	17	——	——
Whatley Prol.	43.57	78.3	1	30.37	2

Remarks—This test is conducted each year to determine the most paying variety of corn. The first planting, April 18, 1925, failed to produce a good stand, owing to dry weather. It was replanted May 16, 1925, in checks three feet apart on three and one-half foot rows. A good stand was secured. Two hundred pounds of acid phosphate mixed with one hundred pounds of nitrate of soda was applied per acre. There were six series.

Conclusions—It would appear from past results and the above table that we are justified in recommending for general planting the following varieties: Whatley Prolific, Mosby, Cocke's Prolific, Hastings, Laguna, and Ellis. Our general plantings for feeding purposes on the Station are made to Whatley Prolific and Mosby.

SOYBEANS

A test was conducted to determine the amount of hay, as well as the amount of grain that the different varieties of soybeans were capable of yielding per acre. Included in this test were the Wilson, Virginia, Laredo, Mammoth Yellow, Biloxi, and Otootan soybeans. The Biloxi and Otootan beans did not mature until October 12 and all results pertaining to them were destroyed by the fall rains. Rains prevented the determination of the grain percentages in each case.

The fertilizer used in this test was a mixture of 300 pounds acid phosphate, 200 pounds nitrate of soda and 200 pounds kainit per acre. The beans were planted on three and one-half foot rows, in hills twelve inches apart, May 16, 1925. It is hardly worth while to mention the extreme dry season that followed. Each plot was 1-24 of an acre.

On September 10, the Wilson and Virginia had matured suffi-

ciently to cut for hay and produced a yield of 1.72 and 1.71 tons of hay per acre respectively. The Laredo and Mammoth Yellow were cut September 23 with corresponding yields of 3.05 and 2.57 tons of hay per acre. While the Wilson and Virginia mature two weeks earlier than the Laredo, we get nearly twice as much hay from the latter. The Otootan is a very desirable bean and will produce as much or probably more hay per acre than the Laredo, but owing to its late maturity, which is three or four weeks later, the harvest will come at a time when cotton is being picked. The Mammoth Yellow and the Biloxi are rank growing beans with very coarse main stems that stock will get very little benefit from unless ground. It has been our pleasure to see the Biloxi bean attain a height of six feet on medium brown loam soil. Soybeans should be planted in every row of corn grown in Mississippi.

TOMATOES

The importance of the tomato to the trucking section has been taken into consideration at this Station. Various tests have been conducted as to varieties, sources of nitrogen, sources of potash, and a test to determine the best formulas to use in producing tomatoes. The most oustanding result of the formula test was that a two year average of 2000 pounds of a 10-3-3 fertilizer per acre produced more tomatoes than any other formula used. This average for two years was 14,773 pounds per acre and 45.9 per cent of this were shippers.

The other tests mentioned follow in table form. A study of these tables will reveal the information contained therein.

TABLE VI—TOMATO VARIETY TEST—1925

Variety	Yield in pounds per acre		Percentage picked early		Percent of total that were shippers	Average size of shippers lbs.
	Total	Shipping tomatoes	Total	Shipping tomatoes		
Gulf States	10317	4668	75.0	77.7	45.2	.259
Richards	12326	5125	76.0	78.8	41.6	.290
Globe	17489	8385	74.2	76.8	47.7	.294
Detroit	11139	5276	80.2	86.4	47.5	.300
Marglobe	16443	9027	73.6	78.1	54.9	.307
Marvel	16644	9009	84.4	89.0	53.9	.292

Remarks—Seed were planted in hot bed January 24, 1925, moved to cold frame February 18 and 19, and sprayed with 3-3-50 Bordeaux for early blight on March 26. A spray of 1-50 arsenate of lead was also applied at this time. The plants were set in the field March 30. This test was conducted in five series.

Conclusions—The data in the above table indicate that the Marvel and Marglobe are about the best varieties to plant, especially on wilt infested soil. The Globe is also a heavy producer and can be safely grown on soils not infected with wilt. Results in the past show the Gulf States to be a leader in high yields.

TABLE VII—TOMATO TOPPING TEST—1925

Method of topping	Yield in pounds per acre		Percentage picked early		Percent of total that were shippers	Average size of shippers lbs.
	Total	Shipping tomatoes	Total	Shipping tomatoes		
Topped 1st cluster	6438	2908	62.9	62.4	45.2	.288
Topped 2nd cluster	10458	5109	70.6	75.3	48.9	.282
Topped 3rd cluster and staked	13381	7990	71.8	81.5	59.7	.283
Topped 4th cluster and staked	19841	9207	70.1	74.8	46.4	.307

Remarks—The above constitutes the only data we have along this line. Topping the fourth cluster and staking the plant seems to increase the average size of the shipping tomatoes. These data were obtained from a test on five series.

TABLE VIII—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH TOMATOES—1924 and 1925

Source of nitrogen	Pounds per acre		Percent shippers	Percent picked early		Total value dollars
	Total	Shippers		Total	Shippers	
1500 pounds of an 8-4-3 per acre						
Nitrate of soda	9614.5	4198.5	44.9	29.1	41.8	265.45
Ammonium sulphate	9659.0	4247.0	43.2	37.0	51.7	268.35
Combination	9503.0	4190.5	43.3	34.8	47.4	264.71
Urea	9725.0	4732.0	48.7	35.9	47.2	296.40
Cottonseed meal	10752.0	4881.0	44.3	33.4	45.2	307.54
2000 pounds of an 8-4-3 per acre						
Nitrate of soda	11054.5	4603.0	42.1	33.5	47.0	292.31
Ammonium sulphate	10318.0	4536.0	45.1	36.4	48.7	286.62
Combination	12899.0	5607.0	44.6	34.6	47.2	354.65
Urea	11155.0	5360.0	48.1	33.2	44.8	336.09
Cottonseed meal	11923.5	5377.0	44.4	31.7	44.4	338.99

Remarks—This test was conducted in two series. Phosphorus was derived from acid phosphate and potash from sulphate of potash. The nitrogen was derived from the sources indicated except in the case of a combination and then equal pounds of nitrogen were derived from nitrate of soda, sulphate of ammonia, and cottonseed meal. A stand was secured in the field, April 1, 1925. An 8-4-3 formula is used for all mixtures.

TABLE IX—AVERAGE RESULTS OF POTASH TESTS WITH TOMATOES, 1924 and 1925

Fertilizer formula	Pounds per acre		Percent shippers	Percent picked early		Dollars per acre		
	Total	Shippers		Total	Shippers	Total value	Cost of fertilizer	Net gain
		1000 pounds per acre						
8-4-0	14437	6135	42.5	30.2	43.8	388.86	10.44	378.42
8-4-3	14952	6249	41.8	34.9	47.6	396.70	12.00	384.70
8-4-6	16041	6792	42.3	34.9	49.1	430.64	13.56	417.08
		1500 pounds per acre						
8-4-0	15133	6207	41.0	35.7	48.7	394.74	15.66	379.08
8-4-3	14086	5913	42.0	32.4	42.5	375.21	18.00	357.21
8-4-6	14239	7866	55.2	28.7	41.3	487.89	20.34	467.55
		2000 pounds per acre						
8-4-0	15103	6333	41.9	33.0	45.2	401.91	20.88	381.03
8-4-3	14642	6566	44.8	35.2	46.7	414.15	24.00	390.15
8-4-6	14924	6631	44.4	31.5	42.3	418.59	27.12	391.47

Remarks—Planted in hot bed January 24, 1925. Moved to cold frame February 18 and 19. Sprayed with 3-3-50 Bordeaux mixture for early blight and 1-50 arsenate of lead for bugs on March 26. Set in field March 30 and a light frost on the morning of March 31 killed seventy per cent of the plants. Reset with plants from Hinds County Agricultural High School April 1, 1925.

In the fertilizer, all phosphorus was derived from acid phosphate; nitrogen from equal parts of nitrogen from nitrate of soda, ammonium sulphate and cottonseed meal; and potash from sulphate of potash.

Conclusions—It would appear from these results and data accumulated in the past that some potash is necessary. We feel absolutely safe in recommending at least three percent in a fertilizer formula.

TABLE X—AVERAGE RESULTS OF ENGLISH PEA FERTILIZER TEST 1924 and 1925

Fertilizer formula	Yield pounds per acre	Dollars per acre		
		Value at 5c	Cost of fertilizer	Net gain
	1000 pounds per acre			
10-3-3	2106	105.30	11.59	93.71
8-3-3	2250	112.50	10.49	102.01
8-4-3	2323	116.15	12.00	104.15
	1500 pounds per acre			
10-3-3	2207	110.35	17.39	92.96
8-3-3	2152	107.60	15.74	91.86
8-4-3	2393	119.65	18.00	101.65

TABLE XI—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH ENGLISH PEAS—1924 and 1925

Rate per acre of 8-4-3	Yield using nitrate soda	Yield using sulphate
1000 pounds	2240	2132
1500 pounds	2233	1941

Conclusions—From the above tables the average for the past two years indicates that 1000 pounds per acre of an 8-4-3 formula, using

nitrate of soda as the source of nitrogen, gives the best results with English peas.

In the first table the nitrogen for each formula was derived in equal parts of nitrogen from nitrate of soda, ammonium sulphate, and cottonseed meal. In 1925, for this table, the Gradis pea was used and planted March 5, while the Alaska was used and planted March 8 in the lower table. This past year the yield was cut very low on account of no rain from date of planting until the vines were dead, April 9, 1925.

TABLE XII—AVERAGE RESULTS OF SNAP BEAN FERTILIZER TESTS—1924 and 1925

Fertilizer formula	Yield in lbs. per acre	Value at 5c	Cost of Fertilizer	Net Gain
	1000 pounds per acre			
10-3-3	4374	218.70	11.59	207.11
8-3-3	3833	191.65	10.49	181.16
8-4-3	3620	181.00	12.00	169.00
	1500 pounds per acre			
10-3-3	4259	212.95	17.39	195.56
8-3-3	3877	193.85	15.74	178.11
8-4-3	4569	228.45	18.00	210.45

TABLE XIII—AVERAGE RESULTS OF NITROGEN SOURCES TESTS WITH SNAP BEANS—1924 and 1925

Rate per acre of 8-4-3	Yield using nitrate soda	Yield using ammonium sulphate
1000 pounds	3833	4083
1500 pounds	4959	5126

Remarks—The above tables show results from tests conducted to determine the amount of the best fertilizer as well as the source of nitrogen for these fertilizers to use in the growing of snap or green beans. Where the source of nitrogen is not designated, it was derived from equal pounds of nitrogen from nitrate of soda, ammonium sulphate, and cottonseed meal. This test was planted to Red Valentine beans March 5, 1925 and no rain fell until the vines were blooming, May 9, 1925. The drouth was no doubt responsible for low yields.

TABLE XIV—CABBAGE FERTILIZER TEST—1925

Amount of fertilizer used per acre	Average size in lbs.	Yield in pounds per acre	Value at 1c	Increase over check
No fertilizer	1.26	6325	$ 63.25	
1000 lbs. of a 10-4-4	1.71	19601	196.01	$132.76
1500 lbs. of a 10-4-4	2.13	26737	267.37	204.12
2000 lbs. of a 10-4-4	2.31	27993	279.93	216.68

Remarks—This test was conducted to determine the amount of fertilizer per acre that would produce the highest yield of the largest size cabbage. A 10-4-4 fertilizer was used with phosphorus derived from acid phosphate, nitrogen from equal pounds in nitrate of

soda and ammonium sulphate, while the potash was derived from sulphate of potash. Cabbage plants were set March 4, 1925. This test was conducted in three series.

Conclusions—It would appear that from 1500 to 2000 pounds per acre of a 10-4-4 fertilizer made from the ingredients listed above would make an ideal fertilizer for cabbage in this section. Conclusions cannot be based on one year's results however.

Several tests of various natures have been conducted on and around the Station that will be of especial interest to the trucking section. Mr. H. H. Wedgeworth of the State Plant Board, cooperating with the Station, had charge of this work.

A part of Mr. Wedgeworth's report follows:

POISONED-BAIT FOR THE CONTROL OF CUTWORMS

"During the spring of 1925 about 15% of the tomato plants were cut by cutworms in the Crystal Springs trucking section, and many other crops were also attacked. In many fields where no control measures were taken losses of from 75 to 90% were sustained. The writer's attention was called to one field where the grower used over 14,000 plants in attempting to secure a stand of tomatoes on one acre that would require about 5,000 plants to give a perfect stand. The severe injuries usually occurred on land that had formerly been in sod or in poorly cultivated field. The cutworm that caused most of the damage is known as the Dingy Cutworm, *Feltia ducens*, according to Mr. H. W. Allen who has identified many specimens collected in this part of the State.

"Poisoned-bait has been recommended for a number of years for the control of cutworms but the practice has not been generally accepted in this State. The main reason for the bait not being more generally used probably lies in the fact that no carefully controlled experiments have been conducted to test the effectiveness of poisoned-bait on the Dingy Cutworm in this State. In view of this fact some preliminary experiments were conducted during the Spring of 1925 at the Raymond Branch Experiment Station to test the value of poisoned-bait for the control of cutworms attacking tomatoes. The bait used in these experiments was made according to the following formula:

Shorts, wheat	5 lbs.	Molasses	½ pint
Paris Green	1½ ozs.	Water	1 gal.

The shorts and Paris green were thoroughly mixed while dry; and then wet with the mixture of molasses and water until damp enough to be of such a consistency that it would fall in small lumps, about the size of oat grains, when sown.

"1. Experiments were conducted to determine the value of poisoned-bait for the control of cutworms.

"2. In the experiment with cages free of vegetation 88% of the

cutworms were killed where poisoned-bait was applied broadcast and 9% died in the checks (probably from injuries obtained in handling).

"3. In the cage experiment where young tomato plants were growing 7% of the plants were cut in the poisoned cages compared with 96.88% cut in the check cages.

"4. In a simple field test poisoned-bait was applied in small quantities near each plant and one row was left as a check. Less than one per cent of the plants were cut on the treated rows compared with 23.65% in the check.

VALUE OF CERTIFIED IRISH POTATO SEED IN MISSISSIPPI

"During recent years the need of Irish potato seed comparatively free of disease has been felt by several of the Northern and Western states. Through the Agricultural Experiment Station and Colleges of these states, the potato growers have developed or selected this type of seed which are known as certified seed. This has been accomplished through the strict requirements for eligibility for certification which requires two or more field inspections and one or more bin or storage inspections. Seed produced under these requirements have met with great success in some of the Southern states, especially in Louisiana whose experiment station in cooperation with the United States Department of Agriculture began testing the certified seed produced by Northern and Western states some five years ago. The extensive use as well as the relative value under Louisiana conditions may be seen by the amount of seed shipped into the state, which was 22 cars in 1922, 85 cars in 1923, and 255 cars in 1924. It is to be regretted that interests in Mississippi have not purchased a single car lot of certified seed during this period so far as the writer has been able to learn. A few smaller shipments have reached the state and have proven to be satisfactory.

"From the results obtained from other Southern states, recommendations of certified seed have been made during the past three or four years but the use has not been generally adopted in this State. In view of the above facts an experiment was conducted on the Raymond Branch Experiment Station to test the value of the certified potato seed under Mississippi conditions.

"One lot of certified seed was secured from each of Nebraska and Wisconson, and one lot of field run stock (uncertified) from each of seedsmen of Jackson and Vicksburg. In cutting these lots of seed, care was taken to have the seed pieces the same size, in order to eliminate differences that might arise from seed pieces of different weights. The soil used in this experiment was of a medium heavy sandy loam type. One thousand pounds of a 10-4-4 (P-N-K) fertilizer per acre was applied in the drill at the time of planting, March 7. The rows were three and one-half feet wide and 124½ feet long, (1-100 part of an acre). The potatoes were planted one foot apart (checks) in the

drill and 1½ inches deep. The different lots were planted in the order given in table 1, and each was repeated three time.

"On May 1 readings were made to determine the amount of leaf diseases in the different lots. Measurements were also made of the heights of the plants in order to illustrate the relative vigorousness of the plants from each lot of seed. At the time of the reading of the vine diseases only a trace of spindling-tuber could be found and the amount was not recorded. After harvesting the potatoes, however, a somewhat larger percentage of this disease was found in the tubers. The predominating disease and very likely the most important limiting factor in potato production in Mississippi was Mosaic. The amount of this disease for the various lots of seed are given in table 1 and a brief description of the disease is given in the following paragraph.

"Plants infected with Mosaic show a mottling, puckering or corrugating effect upon the leaflets when grown in cool or cloudy parts of the season. The diseased leaflets are mottled with patches of light green or yellowish green spots. When such leaves are held between the eye and the light, the varying degrees of color densities may be observed. This mottling and puckering may be masked in diseased plants grown in the bright sunlight or in high temperatures but are very striking on those plants partly shaded. For the same reasons, Mosaic may not be visible on the upper leaves but may be distinct on the lower leaves that were developed during the cooler and cloudy parts of the season. Although environmental conditions play an important role in the appearance of the symptoms of the disease, they do not seem to have much effect upon the amount or severity of the disease. Badly affected plants may be dwarfed, as shown in table XV. The yield decreased from a trace to fifty or seventy-five per cent, depending upon the amount and severity of the disease, but the size and appearance of the tubers may be as perfect as those from healthy plants, thus making tuber selection for disease-free seed impossible.

"The cause of the disease has not been determined but it is known to be infectious, transmitted by bruising the diseased leaves and then rubbing the sap into the healthy plant, or by certain aphids that have fed upon diseased plants and transferred to healthy plants and possibly by some other insects. Tubers produced on infected plants are usually infected and carry the inoculum over to another season. Certain aphids may also carry the inoculum over the winter to the following season.

"On June 1 the potatoes were harvested and sorted into the various classes. These results are given in table XV. The relatively large yield of tubers from one and a half to two inches in diameter is undoubtedly due to the extended drought in April. When the rains finally came the potatoes set a "second crop" which did not reach full size before the plants matured.

TABLE XV—RELATION OF CERTIFIED AND UNCERTIFIED IRISH POTATO SEED ON PER CENT OF GERMINATION, AVERAGE HEIGHT OF PLANTS, PER CENT OF MOSAIC PLANTS AND YIELD PER ACRE

Kind and source of seed	Percent of germination	Average height of plant inches	Mosaic plants %	Bushels per acre			
				Diameter of tubers inches			
				2 or more	1½ to 2	Culls	Total
Uncertified Lot No. 1 Vicksburg, Miss.	90.56	10.01	68.07	36.81	58.98	14.91	110.70
Certified, Wisconsin Eagle River, Wis.	99.72	13.18	2.78	83.84	86.11	16.42	186.37
Uncertified Lot No. 2 Jackson, Miss.	93.61	9.74	32.24	33.34	80.14	22.85	136.33
Certified, Nebraska Alliance, Nebr.	99.17	14.49	2.52	91.51	96.88	16.23	204.62

SUMMARY

"1. Two lots of certified Irish potato seed were tested in comparison to two lots of uncertified Irish potato seed.

"2. Certified Nebraska gave the highest yield and was closely followed by certified Wisconsin.

"3. Both uncertified lots of seed had a high percentage of Mosaic, lot No. 1 having the highest percentage of disease yielded the least amount of tubers.

"4. Data given in table XV indicate that the higher the percentage of Mosaic the smaller the average size of the plants, thus showing that the disease tends to dwarf the plants.

"5. The certified lots of seed gave a much better stand of potatoes which is probably due to the fact that they were from plants that were sprayed for disease and contained less late-blight and possible other rots."

A NON-FERMENTING METHOD OF SAVING TOMATO SEED

"Tomato seed may be separated from the pulp by the following procedure: Ripe fruits of the tomato are crushed or cut into pieces—this operation is best accomplished by passing the fruits through an ordinary corn-sheller. The crushed product is then washed, by means of a strong stream of water from a hose, through a series of screens in the following order: 1 mesh, 2 mesh, 4 mesh, 4 mesh, 8 mesh, and finally onto a 16 mesh wire. Each of the screens take out portions of the pulp according to the number of mesh. After the seeds and very small pieces of pulp are washed onto the 16 mesh wire, the entire content of this screen is transferred into washing containers; 50 pound lard cans are very convenient. Since the seeds settle to the bottom of the container much faster than the fine pulp after water has been added, the fine pulp is decanted off just at the state when the seeds

have settled. Three or four washings, depending upon the quantity of the seeds being washed, are required to clean the seed. After the seed have been washed clean, they are transferred to a small container (pail) with a perforated bottom and the excess water is thrown off by whirling (centrifugal action) the container a few times. The seeds are now ready to be transferred to the cheesecloth drying racks. If they are spread in a thin layer on the racks they will dry in a very short time under favorable weather conditions.

"This method has the following advantages of some of the fermenting processes in use:

1. Less equipment is required.
2. The work is more agreeable.
3. Requires less labor (with about 25 man days 58 pounds of seed were saved at the Raymond Branch Experiment Station in 1925).
4. Seeds are easier to dry after placing on drying rack.
5. Eliminates the danger of injuring the seed from fermenting too long, thus giving seed that have a very high germination percentage (97% for seed saved in 1925)."

GENERAL WORK

The Station farm has been terraced and surface drainage is practically controlled. Several rotations are under way, whereby legumes play a prominent part. Irregular soil types found in the same field are gradually being eliminated by growing winter cover crops and summer legumes, in order that these fields may be used for more delicate experimental work. At present there are several acres each growing to a nice stand of vetch, bur and crimson clover. Many acres are now green with fall oats.

Our pasture is well seeded to lespedeza, one of our native soil builders, as well as to white clover, bermuda grass, and paspalum. There is also a project wherein lespedeza is grown to determine its value to a cotton crop that may follow.

A young orchard with several varieties of peaches, apples, and grapes is now growing nicely and will be used as a demonstration, besides determining the best spraying materials to use in growing the most adaptable varieties.

In conclusion, it might be well to state that the past growing season has been the driest in many years and in reviewing the data herein contained, constantly keep that fact before you.

Bulletin 232 December, 1925

Report
South Mississippi Branch Experiment Station
1925

By

E. B. FERRIS and W. S. ANDERSON

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. RICKS, Director

STATION STAFF

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M. H. MOORE.....Secretary and Business Manager
J. R. RICKS, M. Sc.....Director and Chief in Agronomy
BEN F. HILBUN, B. Sc.....Agricultural Editor
E. B. FERRIS, M. Sc.....Assistant Director, South Miss. Branch Station
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S. W. GREENE*.....In charge of Coastal Plains Branch Station
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R. W. HARNED, B. S. A.....Chief in Entomology
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J. M. BEAL, M. Sc.....Botanist
E. P. CLAYTON,.....Poultry Husbandman
W C. MORSE, M. Sc.....Geologist
LEWIS E. LONG, M. Sc.....Research Economist
D. C. NEAL,** B. Sc., M. A.....Plant Pathologist
J. F. O'KELLY, M. Sc.....Plant Breeder
J. C. C. PRICE, B. Sc.....Horticulturist
MISS DOROTHY DICKENS, M. Sc.....Head Research Home Economics
C. J. GOODELL, B. Sc.....Associate in Animal Husbandry
C. B. CAIN, V. M. D.....Veterinarian
R. V. RAFNEL, V. M. D.....Veterinarian
H. W. ALLEN,** B. Sc., M. Sc.....Assistant Entomologist
J. M. LANGSTON, B. Sc.....Assistant Entomologist
R. N. LOBDELL, M. Sc.....Zoologist
W. C. COWSERT.....Assistant in Dairying
W. S. ANDERSON, B. Sc.....Horticulturist, South Miss. Branch Station
H. A. YORK, B. Sc.....Asst. at Delta Branch Station
J. B. TURNER, B. Sc.....Asst. at Delta Branch Station
OTIS B. CASANOVA, B. Sc.....Ass't. at Holly Springs Branch Station
H. H. HARNED, M. S.....Associate Bacteriologist
ROLAND COWART,** B. Sc.....Asso. Agronomist
MISS KITTIE SUE JOHNSON, A. B.....Secretary
MISS FANNIE PAGE.....Stenographer
MISS MARY ALICE LANIER.....Addressograph Operator
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D. MAXWELL.....Foreman and Herdsman
B. V. EVANS.....Farm Foreman, South Miss. Branch Station
J. C. RYAN.....Farm Foreman, Holly Springs Branch Station
J. C. PEYTON.....Foreman, Raymond Branch Station
K. C. LIVINGSTON .....Foreman, Delta Branch Station
F. O. CORK, B. Sc.....Supt. Farm Management Vocational Project
H. B. BROWN, Ph. D.....Collaborator
E. C. EWING, M. Sc.....Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept of Agr.
....**On leave.

A Report of Work at South Mississippi Branch Experiment Station for 1925.

Introduction—1925 will possibly go down in history as the most favorable year South Mississippi has known for the past quarter of a century and we can only hope that it will be followed by many similar years. 1924 was an exceptionally good year for cotton due to the small amount of rain throughout the entire year, but this deficiency in rainfall was really too great for cotton and practically ruined all late corn, sweet potatoes, sugar cane and lespedeza. On the other hand 1925 was quite dry enough for the maximum production of cotton, sufficient rains coming in midsummer to enable the setting of sweet potatoes, the development of corn and the growth of sugar cane, becoming dry and hot again just in time to save the cotton from the boll weevil.

The weather then remained dry through September enabling practically all cotton to be picked, ginned and sold while the grade was good and the price at its best. Late rains and a few light showers in September enabled sweet potatoes, sugar cane and late planted crops of all kinds to take on new life and to develop rapidly for several weeks. The result is that much of the land made a bale or more of cotton to the acre, average amounts of corn, good potatoes and cane, while fruits and vegetables earlier in the year go down as among the best the section ever produced.

Cotton and Corn—A circular each on corn and cotton have been issued giving in detail the work done here with these crops and it will be sufficient to say here that possibly the best work ever done with the two crops has been reported in these circulars. This has been due to two causes, in the main to the ideal seasons and again to the fact that we had leased additional land for carrying on work with fertilizers, this land being almost perfectly uniform, practically level, well drained, and sufficiently large to give room for a number of replications with the fertilizers used. Another factor that has had much to do with the amount of good this work has accomplished is the fact that large numbers of visitors have come to the station throughout the year and have been able to see the work and to carry the information home to others.

Nearly all the County Agents from South Mississippi counties have headed delegations of farmers and business men on visits to the station, but these have constituted only a small part of the ones who have come alone and in smaller parties to inspect the work. A large part of the time of two men has been taken up here this year, between the time of laying by crops and the harvesting of the same, in showing visitors over the station. Much of the time of the assistant director

and horticulturist has also been spent in making talks at farmers' meetings, judging exhibits at many community, county and sectional fairs and in helping to award prizes given by other organizations to encourage better agriculture.

Dairy Cattle—On account of the presence of ticks and the quarantine incident thereto this station found it advisable earlier in the year to dispose of its herd of registered Jersey cattle. All these animals had been freed of ticks when dipping was compulsory in the county and had since been kept on tick free pasture. The county stopped dipping two years before and ticks were again as plentiful as they had ever been, leaving us surrounded by infested ranges and constantly in danger of losing valuable animals. Such animals were lost from time to time as a result of ticks, no surplus cattle could be sold on account of the quarantine, and the country was in no shape to profit by any experiments that might be carried on here with dairy cattle, since in the main they were selling their herds rather than buying others. So, arrangements were made with the Holly Springs Branch Station to take these cattle until such time as conditions will warrant our station doing further work with such animals.

Six-weeks Cowpeas.—In doing work here with varieties of cowpeas we have found much trouble in getting peas that will resist nematodes and produce fruit. A good many of the standard varieties survived the nematodes but practically none of these bore enough fruit to warrant their being grown. In making these tests we found some locally grown peas that always fruited remarkably well and were at least sufficiently immune to nematodes to bear excellent crops of peas every time they were planted. A news letter telling about the fruiting qualities of these peas, brought scores of inquiries about them from farmers over four or five southern states saying they wanted a pea that would fruit, as they were having the same trouble that we described in getting peas to fruit. The result of this demand was that we distributed about a dozen bushels of these peas in small lots of one peck or less to a number of people scattered widely over this and adjoining states. The demand for these peas continues to come and this year, after disposing of the dairy cattle in June, twenty-two acres of the pasture land was prepared and planted to such peas between August 1 and September 1. The extremely dry weather was responsible for a rather poor growth of vine with these peas, still they fruited remarkably well and were cut, vine and all, when ripe, have been stored and will be threshed at the first opportunity. A large number of requests for these peas have been listed and they will again be sold in such quantities as to distribute them to all who have asked for them, charging the market price.

About one and one-quarter acres of ground were planted to these peas this year on May 15, following a crop of rape. They made a remarkably good growth of vine and fruited so abundantly that it appeared they had all turned to peas. On July 25 one grown hog and

kept there without additional feed until August 15 when they had largely consumed them. These hogs were again weighed and had gained 390 pounds, weighing a total of 2015 pounds.

Four plats of land of one-twentieth acre each were planted alone to these peas on May 15 and four other plats of same size were planted to corn and peas at the same time. This was on land being used in our soil fertility work where we are testing the soil building qualities of the three standard legumes of the section, cowpeas, soy beans and velvet beans grown alone and with corn, as measured by a crop of cotton following. These six-weeks peas planted alone averaged at the rate of 32.2 bushels per acre which was reduced to 19.7 bushels when corn was planted with them. On the other hand corn made 35.6 bushels per acre when grown alone and this was reduced to 29.5 bushels when the peas grew with it. This seems a remarkable showing for these peas, which, if sustained in the future, would make them by far the best legumes for the section.

Soy Bean Varieties.—On April 1, six varieties of soy beans were planted here, one row to the variety and repeated six times. These beans were planted on land prepared and fertilized for cotton and cultivated just as we did the cotton growing nearby. These beans ripened from July 18 to Oct. 25, and as they ripened were cut, housed, and the percentage of beans to hay determined by threshing small lots by hand. The variety planted as Mammoth Yellow evidently was misnamed by the seedsman selling it as it had no characteristic of this variety as grown here before. The Biloxi bean ripened so late that it had shed practically every leaf when harvested so that the yields as shown appear abnormally small. They also fruited very poorly and gave decidedly the lowest yield of beans among the six kinds. These varieties were cut on the dates mentioned and gave yields of forage with beans, and beans alone calculated in pounds per acre as follows: Wilson, July 18, 1366 pounds hay, 407 pounds beans; Virginia, July 18, 1535 pounds hay, 613 pounds beans; Mammoth Yellow, September 9, 2866 pounds hay, 713 pounds beans; Laredo, September 9, 3000 pounds hay, 720 pounds beans; Biloxi, October 25, 2400 pounds hay, 240 pounds beans; Otootan, October 25, 4533 pounds hay, 1007 pounds beans.

Cooperative Work.—The only real cooperative work done this year with field crops under station supervision was with T. E. McCardle near Hattiesburg, Mr. W. M. Sellers, County Agent, being entitled to much of the credit for this. Here the work was done with fertilizers under cotton and is reported in detail in our circular on this crop. Seed from a number of varieties of cotton, corn and soy beans were furnished Mr. T. H. Montgomery, County Agent of Lawrence County, and were used by him in conducting some experimental plats near Monticello. Plans were also furnished Mr. Montgomery for conducting simple experiments with fertilizers on this land. Mr. Montgomery resigned before the end of the year and we have no report as to the good accomplished by the experiments. We also furnished very small

amounts of cotton seed, six-weeks pea seed and seed corn to a number of agriculturists in Smith-Hughes schools in South Mississippi for use in teaching their classes the leading characteristics of these varieties. No reports have been received, nor were they expected from these.

Cooperative Work with State Plant Board.—The same work mentioned in our report for 1924 has been carried on in 1925 with the State Plant Board which has kept a representative here all the year. Up to December 1 their representative was Mr. R. C. Price, who then resigned and was succeeded by Mr. J. E. Lee. This station furnished land for growing an acre of wilt-resistant tomatoes for seed production and another acre for bedding some 700 bushels of sweet potatoes for use in the weevil sections of Pearl River County. Mr. Price carried on poison work here on cotton against the boll weevil and supervised the use of poison on all station cotton. To a certain extent the Plant Board was furnished the use of teams and implements in growing a considerable acreage of sweet potatoes with the idea of producing their own seed for 1926. A report is made in the circular on cotton of the results of poison work against the boll weevil, showing that early poisoning did not pay, but that poisoning by the Coad method gave an increase of 261 pounds of seed cotton per acre.

Java Sugar Cane.—For several years Mosaic disease has done great damage to sugar cane in this section. Early in 1925, Mr. D. C. Neal, Plant Pathologist of the main station at A. & M. College, sent us sufficient canes of Cayana No. 10 Sugar Cane to plant about one-sixth of an acre. It was planted on land already prepared for cotton, but was given additional fertilizer in mid-summer. While the seasons were rather dry, this cane made a remarkably good growth and possibly yielded at the rate of 25 tons per acre. It was all cut just before frost and banked with dirt. A "News Letter" sent out by us several weeks ago telling of this cane and agreeing to send it to those who would pay the cost of packing and shipping, has met with ready response and numbers of letters are being received requesting a start of this cane. Four additional varieties of this cane were sent here at the request of Mr. Neal and grown near that above mentioned. There was not enough of this to distribute and all has been used in increasing our planting for another year.

Winter Cover Crops.—In the fall of 1924 as crops were harvested, oats were sown and worked in with tractor disc. After cotton, this was done early in September and completely destroyed the cotton stalks, and stopped the boll weevil. These oats lay in the ground until December without sufficient moisture to germinate them. Following rains they came up to good stands, grew well through winter, furnished considerable grazing to dairy cattle and were largely turned under in March as the lands were prepared for various crops. We cannot recommend too highly the oat as a winter cover and grazing crop for South Mississippi for while it lacks some of the good qualities of winter legumes, it is a sure crop here and absolutely the least expensive one to grow. Many oats have again been planted this fall

following both corn and cotton and in addition to these we have planted several acres to rye, more than an acre to rape, besides considerable vetch, burr clover, crimson clover and white clover.

Lespedeza.—A considerable acreage was planted to lespedeza last year, intended both for hay and pasture. The extremely dry season killed a lot of this lespedeza and none of it reached a height at which it could be cut. All this was gone over in February of 1925 and reseeded where it appeared the stand had been lost. The very dry spring and early summer prevented the germination of these seed, so that very poor stands were obtained and our lespedeza this year, except for grazing, has amounted to nothing, none of it having been cut.

Rotation Experiments.—The same work done heretofore with these rotations was again carried on in 1925 and exceptionally good yields of cotton and corn obtained. We find that a mistake has been made in the past where testing corn and legumes together in not planting both at the same time, for experience has shown that the legumes will not thrive planted with corn if not done at the same time, or in separate rows if planted later. By not so doing, we have lost much of the effects of these legumes grown with corn in these rotations. Hereafter this planting of corn and legumes at the same time will be done and we believe will result in a material improvement in the land as a result, causing the plats where legumes are grown to show better yields than others where left out, a thing that has not been apparent heretofore.

Horticultural Work.—Excellent work has been done this year with a number of fruit and vegetable crops, including sweet potatoes and will be reported on by Mr. W. S. Anderson in charge of the horticultural work of the station. This work has attracted a great deal of attention from our numerous visitors and has aided greatly in popularizing the work of the station.

Distribution of Pure Cotton Seed.—In 1923, Mississippi Station Trice cotton did so well here and elsewhere in the state that a great demand arose for the seed. We had previously been much pleased with this cotton here in the way it had produced as compared with other varieties. These seed were saved pure in 1923 and distributed among growers who agreed to keep them pure. This was done again at the end of 1924 when a much larger quantity of Trice seed was available. Again this year these seed have been kept pure and we have available for another year pure Mississippi Trice seed from eighteen bales of cotton, besides that from several hundred bushels of planting seed let out in the spring. 1924 and 1925 have been such dry years and the weevil so completely controlled as a result thereof that early cottons like Trice have shown no superiority over other later maturing kinds. The result will likely be that the people will substitute other kinds for it and possibly make mistakes. We still believe Trice to be the safest cotton for South Mississippi.

Soil Fertility Tests.—Mention has been made many times of 32 plats of land set aside here in 1922 for testing the soil building prop-

erties of three standard legumes, cowpeas, soy beans and velvet beans grown alone and with corn, also corn alone. This work is done on eight plats of land, repeated four times, all of which grew cotton in 1924 and all planted again to the several crops in 1925. It is interesting to note here the effects of these several crops on the yields of each other. Corn alone made 35.6 bushels per acre which was reduced to 29.9 bushels when soy beans were grown with it; to 29.5 bushels with cowpeas; and to 13.6 bushels with velvet beans. Cowpeas alone made 32.2 bushels per acre which was reduced to 19.7 bushels when grown with corn; soy beans alone made 12.1 bushels per acre and this was reduced to 6.9 when grown with corn; velvet beans did not fruit at all when grown alone and made approximately 21 bushels with corn.

REPORT OF HORTICULTURAL WORK AT THE SOUTH MISSISSIPPI EXPERIMENT STATION FOR 1925.

By W. S. Anderson, Horticulturist.

The investigations in horticulture as reported in bulletin 225 from this station, have been continued in the main, during 1925. These projects may be grouped as follows:

I. Plant Breeding and Selections for Varietal Improvement.
II. Fertilizer Tests.
III. Variety Tests.
IV. Cultural Tests.
V. Cooperative Tests.

Plant Breeding and Selections for Varietal Improvement. The work with selection of Nancy Hall sweet potatoes for improvement of the variety has been continued again this year as in the past four years, but the results this year have not been so indicative of benefit as in the past. As reported in Circular No. 57 from this Station last year, the "H. Y." or high yielding strain made an increase in production the first year of 19% over the "L.Y" or low yielding strain; 15% the second year of the selection; and 23% last year or the third year of the selection. This year we have to report the following yields: "H. Y." strain, 103.6 bushels of No. 1 grade potatoes; "L. Y." strain 128.8 bushels of No. 1 potatoes. This shows a 14.6% increase in yield in favor of the "L. Y." strain. This selection will be continued with renewed interest another year.

The work begun two years ago with the selection of favorable individual plants in a planting of some five hundred specimens of wild blueberry from Florida has been continued. During 1925 vigorous growths were made by the many kinds and fruit was borne by most of them. We made selection of twelve apparently distinct types. Studies are being made of the various characteristics of these types and their relation to the production of fruit of marketable and culi-

nary value in sufficient abundance to warrant their propagation for general distribution.

VARIETY TESTS

Vegetables—The only work done with varieties of vegetables this year was the testing of three of the most commonly planted varieties of sweet potatoes. Draws of Nancy Hall, Porto Rico, and Triumph varieties were set out on April 8th in well prepared land that had been previously fertilized at the rate of 500 pounds per acre of an 8-4-8 mixture. The plats were composed of one row each and repeated six times in the field for accuracy in computing results. A representative series of these plats was harvested on August 15th and the remainder dug October 7th. The following tables show the production per acre of these varieties:

SWEET POTATO VARIETY TEST—DUG AUGUST 15TH.

Name	lbs. No. 1	lbs. No. 2	lbs. No. 3	lbs. Jumbo	Bu. No. 1	Bu. No. 2	Bu. No. 3	Bu. Jumbo
Nancy Hall	2057	514	1776	374	36	9	31	6
Porto Rico	7293	1075	1730	2384	130	19	30	42
Triumph	7573	1075	1730	2244	135	19	30	40
PLATS DUG OCTOBER 7TH YIELDED THE FOLLOWING FIGURES.								
Nancy Hall	3113	1402	2554	841	55	25	45	15
Porto Rico	8910	1963	2431	3553	159	35	43	63
Triumph	7386	2337	3085	3113	131	41	55	55

A study of the above tables will reveal the facts that on basis of No. 1 sweet potatoes from early digging Triumph led, with Porto Rico a close second, and Nancy Hall far behind as third; that on basis of total marketable roots, No. 1 and No. 2 dug early the rank was the same as above; that on basis of No. 1 when dug late Porto Rico was in the lead with Triumph not far behind as a second and Nancy Hall third again; and that on basis of total marketable roots dug late the ranking order was the same. These facts are interesting because the sweet potato growers are either interested in the production of the greatest amount of No. 1 roots for some high priced early market, or in the production of the greatest amount of total marketable roots for the canning industry in the fall when the sweet potatoes can be left until entirely mature, or further, in the production of the largest amount of marketable roots to be stored in a modern curing house for selling on the spring markets. From our experience here, we believe that where the market desires a yellow potato, the grower will do well to plant the Porto Rico.

Fruits—In the main the many varieties of fruits as reported in previous issues from this office have made good growths this year, and also many have borne fruits in creditable amounts. One of the most interesting groups of fruits that we are testing is the peach, of which we have something like thirty-five varieties, a careful record being kept of each. Below we give in brief outline the record of the production of peach varieties this year:

PEACH SUMMARY FOR 1925

No. of trees bearing	Name of Variety	Lbs. average per tree	Bu. average per tree	Highest yield per tree lbs.	Highest yield per tree bu.	Date began ripening
2	Early Mamie	36	.7	46	.9	July 3
11	Rose Hiley (Clean Culture)	71	1.4	131	2.6	June 15
6	Hiley (Sod)	17.6	.3	51	1	June 15
8	Hiley (Alt. Sod)	54.5	1	71	1.4	June 15
7	Hiley (Alt. clean)	35.7	.7	46	.9	June 15
29	Ga. Belle	112	2.2	316	6.3	July 7
15	Hiley	90	1.8	148	2.9	June 15
38	Slappy	60.8	1.2	111	2.2	June 25
1	Carmen	18	.3	18	.3	June 25
2	Walde	85	1.7	88	1.7	June 16
2	Jewel	62	1.2	66	1.3	June 8
1	Glen	53	1	53	1	June 16
2	Honey	44	.88	57	1.1	June 18
2	Fla. Gem	55	1.1	72	1.4	———
2	Imperial	84	1.6	121	2.4	———
2	Colon	15	.3	18	.3	June 23
9	Elberta	7	.14	17	.34	June 23
31	Early Elberta	5	.1	24	.48	July 17

A study of the above table shows that with probably one exception the same varieties that made creditable yields of fruit in 1924 did so again in 1925. Early Rose, which was a high producer of fine fruit that ripened early in 1924, failed to set any peaches this year. As has been reported in a news letter heretofore, this variety is a very late blooming one, and this year tried to bloom and set fruit during one of the driest times which the section has ever seen. Other and more early blooming kinds had set their crops before the moisture had become so completely exhausted. Although not ready to commit ourselves finally on the matter, we feel that the failure of Early Rose to set fruit this year was due very largely to weather conditions at the time of blooming. These conditions will be watched in the future and reports rendered according to our findings.

It is interesting, although not very pleasantly so, to note from the tables that the South's most famous variety, Elberta, has practically failed with us. Less fruit was produced this year than last. Since other varieties commonly planted in the section are bearing well under the same treatment as given to Elberta, we are at a loss to know why the latter does not bear fruit. We have observed that the tree growth of this variety is rather abnormal in that there are a large number of small suckers put out rather low on branches each year instead of the tree making normal terminal growth. The few fruits produced are

large and showy and have fine quality.

We have planned for next year a series of tests which are designed to find out why Elberta does not bear with us here. These include changes in methods of pruning, cultivation, and fertilization. It is hoped that these tests will result in our being able to report favorably on Elberta for South Mississippi.

As a group the Florida varieties, including Walde, Honey, Fla. Gem, Colon, and Glen, which we have been testing in an effort to find a good early peach, have as yet been unfavorable. However, this year the fruit produced by Jewel and ripened on June 8th was of sufficient size and had enough quality and color to make it a good seller at that time. The fruit of this ripened from two to three weeks earlier than last year and the peaches were about twice as large as last year. All peaches were fertilized this year with eight pounds per tree of an 8-4-6 mixture, made from 600 pounds acid phosphate, 300 pounds nitrate of soda, and 150 pounds sulphate of potash. This was applied just before growth began in the spring and immediately worked in with a disk harrow. The cultivation was kept up regularly until August 1st. A winter cover crop of oats has been planted in the orchard this fall about October 15th, to be turned under in the spring of next year. Spraying of bearing varieties was done in keeping with recommended schedules, using arsenate of lead as an insecticide and Atomic Sulphur as a fungicide. As a dormant spray we used Oil Emulsion in the fall, and Concentrated Lime-Sulphur in the late winter application, the former being diluted to 1 to 30 and the latter diluted 1 to 7. This schedule of spraying has given us fair control of all pests on peaches here.

Plums in the variety test have not progressed far from their position of last year. Munson, the large yellow one that has been very attractive in its performances here for the past three years, was again in the lead with a yield of 157 pounds of fruit this year. It is not a strong grower, but sufficiently so that it never fails to have enough wood for a fine crop. It sets such heavy crops that we have to thin the fruit every year. Santa Rosa looked better this year than it has heretofore, producing an average on two trees of 39 pounds of fruit of large size, and good quality. It ripened about the tenth of June, whereas Munson was ripe the last week in May. Both varieties ripen over a long period making them favorable for home orchard plantings. Mammoth Gold was better this year also, making 24 pounds average production on two trees. It is much less to be favored, however, than either of the two above mentioned on account of its weakness of tree. Burbank, Improved Wild Goose, and Wickson were still less favorable producing respectively 11, 14 and 3 pounds of fruit average per tree. America and Gold are still unfavorable. Two Compass Cherry-Plum trees were planted in the variety test this year and they came through with creditable growths.

None of the Apricot varieties under test have set friut yet, and this being the end of the fifth season, we hold very little in store for

them in the future, although the trees are vigorous.

Both Sultana and Princess varieties of Almond set fruit this year but neither held them until matured. Trees of both are still maintaining fair vigor.

The greater part of the varieties of apples in the test have continued their vigorous growths this year, but some have died of attacks of blight, apparently. One tree each of Wilson Red June, Sorsby, and Golden Delicious has succumbed to attacks of this blight. All of the above named varieties together with Day, Red Astrachan, Staymen Winesap, and Florence Crab, bloomed and set a few fruits this year. Rambo and Mother are two others that are making very vigorous growths but have not yet fruited.

All pecan varieties in the test made fine growths this year and a few nuts were produced by Stuart, Success, Schley and Teche.

Japanese varieties of persimmons in the test made good growths this year and fine crops of fruit were produced by Tane-Nashi, Triumph, and Zengi, while a few fruits were ripened by Ormond and Tamopan. Triumph and Tane-Nashi seem to be much preferred.

All pears, including Pineapple, Favorita and some others unnamed, that have been sent here from Washington for trial, have made good growths and the Pineapple bore its first fruit.

All of the twelve varieties of figs made the usual good growths this year and also made in the main the usual poor crop. We harvested only fair crops from Brunswick and Green Ischia, with a few from Black Ischia and Black Mission. We are quite uncertain yet whether we will be able to find any variety of fig that will do well under our system of clean orchard cultivation. Our observation is that the same varieties that we have under test here are doing excellently well in this vicinity when planted and handled under backyard conditions, where there is an ample supply of moisture and fertility with no root disturbance by cultivation.

As it has been reported in a news letter from this office earlier in the year, the grapes in our variety test here have made a wonderful showing, considering the fact that such a heavy crop was made last year with such a shortage of moisture, and the fact that there was very little rainfall this year up to the time the vines ripened their crops. A few varieties, we are sorry to say, fell by the wayside this season as they died from unknown causes. These were Niagara, Captain, and Mericadel. The last two were so unfavorable that we do not plan to replant them, but we expect to replace the Niagara because it has been one of the most favorable varieties in the test. The varieties of Muscadines continued to be very outstanding as a vine crop for this section. Below we give tables of yields for this year of both bunch grapes and muscadine grapes:

SUMMARY OF YIELDS OF BUNCH GRAPES FOR 1925

No. vines bearing	Name of Variety	Yield in lbs. average per vine	Yield in lbs. Highest per vine	Average yield per acre (484 vines)	Date Ripe	Rank as to yield
10	Ellen Scott	10.4	19	5,033	7-10	8
2	Concord	29	39	14,036	7-15	6
2	Wilder	34	38	16,456	7-17	5
1	Carmen	15	15	7,260	7-22	7
2	Lukfata	7	7	3,388	7-22	9
1	R. W. Munson	6.5	6.5	3,146	7-22	10
1	Ronalda	48	48	23,232	7-25	1
1	Edna	44	44	21,296	7-30	2
1	Herbement	38	38	18,392	8-7	3
1	Muench	35	35	16,940	8-6	4

SUMMARY OF YIELDS OF MUSCADINE GRAPES FOR 1925

				(286 vines)	-	
1	James	79	79	21,172	8-17	1
5	Thomas	64	85	17,152	8-18	2
1	Scuppernong	30	30	8,040	8-18	3
2	Flowers	25	25	6,700	9-1	4

The test of European varieties of bunch grapes grafted on Lenoir stock has been very unsatisfactory and is practically eliminated from consideration. All vines that have not yet died are very lacking in vigor and it is expected that they will die within another year.

The various varieties of citrus fruits have made wonderfully fine growths this year. At the end of the second season after the freeze of 1924 our trees of all varieties are practically as large as three year old trees were before the freeze. Although there is yet some thinning necessary to properly shape the trees, they are substantially as good as before the freeze. The satsumas have, of course, not reestablished themselves as fast as the grape fruit and round oranges, but they are now from four to six feet in height. Fruit was produced by almost all varieties. The satsumas made from a few fruits up to as many as 107 per tree. Pineapple and Lue Gim Ging round oranges seem to come back stronger than others of their kind. The Pineapple tree stands about eight feet high now and ripened early, about November 1st, 14 fine fruits. Lue Gim Ging stands only about five feet in height but has on it now turning 44 oranges. The Duncan variety of grapefruit has borne a very large crop of fruit this year, one tree having 44 fruits now and the other 24. Foster grapefruit has been more vigorous in growth but bore only a few fruits. These, however, are of very large size. Tangerine trees bore only a few fruits. The two varieties of Kumquat have made fine growths and are loaded with fruit. Maruma seems slightly more hardy than Nagami, but the fruit of the latter is much larger and better in quality. The Thomasville Citrangequats secured from the Department of Agriculture at Washington last winter have made very vigorous growths this year and appear to be very hardy. As is our usual custom, all citrus trees have been banked with dirt to a height of about 18 inches as a precaution against loss from severe freeze. Our single tree of Meyer lemon has made excellent

growth since the 1924 freeze, and this year bore four fruits of large size.

The several species of Rubus, briar berries introduced in recent years from foreign countries and planted here two years ago, have in the main made good growths this year. Two of them ripened a few fruits but these were of poor quality and exhibited very little prospects of being of any commercial value. The Thornless Dewberry planted the first of last year has made little showing this year and appears unfavorable. The Van Fleet Rasberry planted two years ago seems rather favorable, making excellent growth and ripening a few berries this year.

In January 1925 we received from Whitesbog, N. J., seven varieties of northern type blueberries and planted them in our test plats here. There were included Cabot, Adams, Pioneer, Sam, Grover, Harding and Rubel varieties. These plants all started off with rather favorable appearances, but as time went on they weakened more and more, and by September 1st all had died but two plants of the Harding. We are sorry to report that before December 1st these, too, had died. Thus it appears that we will fail to get satisfactory results from northern type of blueberries in this section. However, we expect to try others next year.

Cultural Tests—The work with sod culture, clean culture permanently, and alternate clean and sod culture with peaches and figs has been continued as in the past. We have kept tab of all observations as to the nematode infestation on the several plats, but up to date have not made notice of anything of value in the control of this pest. There is a slight infestation of nematodes in some of the plats but not enough to cause any injury as yet. Of course, we have quite a fine demonstration of tree growth and fruit production on this series of plats. The trees on clean culture permanently being more than four times as large as those on permanent sod, and the former are producing an average per tree of 71 pounds of peaches, and the latter only 17.6 pounds, as shown by the tables accompanying this report. Both plats have been handled the same except for culture.

Cooperative Tests—The test in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture with European grapes grafted on American varieties as stocks has been continued this year. Although this is the end of the third year of the test, we are not yet in position to recommend the planting of these grapes only experimentally. Our observation today December 10th, shows the following:

Muscat-Hamburg on Catawba made fair growth this year but all died since growth stopped; same on Missouri Reisling, made small growth and two vines are yet alive; same on Brilliant, made fair growth but none lived to the end of the season; same on Ives, made good growth, from five to fifteen feet, and three vines are living and appear in healthy condition; Chasselas-Fontainbleau on Ives, made excellent growth, some vines being over 20 feet long, and four are living,

exhibiting vigor and hardiness; same on Brilliant, made rather poor growth and two are alive; same on Missouri Reisling, made fair to good growth and three are alive, showing up fairly hardy; same on Catawba, made excellent growth, some vines being 20 feet long, and five are alive, being the most hardy and vigorous appearing combination in the test; Malaga on Catawba, Missouri Reisling, Brilliant, and Ives, all made fair growths this year but none are alive today, dying back after growth stopped; Sultanina on Ives, three are alive and made good growths this year, appearing reasonably hardy; same on Brilliant and Missouri Reisling all dead; same on Catawba, one alive and made poor growth this year. A few clusters of nice fruit were borne by all vines of both Muscat-Hamburg and Chasselas-Fontainbleau, the quality being good, although not equal entirely to that of the California grown grapes.

The cooperative pear stock propagation test started in 1923, in which Mr. F. C. Reimer, of the Experiment Station of Talent, Oregon, furnished several trees of two species of pear used for stocks in that section to our station for growth and rooting of cuttings from them has been continued this year. In early December 1924 we made 100 cuttings from each of these species, Pyrus calleryana No. 1 and Pyrus calleryana No. 2, and lined them out. The spring of this year was very dry, and as was our experience in 1924, we lost the greater part of these cuttings. Only two grew, and these were of Pyrus calleryana No. 1.

Being constantly approached with questions about the fertilization of pecan trees in this section and not being able to conduct any fertilizer work with pecans on the station due to the small size of our trees, we secured the cooperation of Ex-Governor Theo. G. Bilbo in starting a test this year in his grove, one mile south of Poplarville. The trees in the Bilbo grove are about eighteen years old, and have been bearing for several years. They are planted 54 by 54 feet, are nearly all of the same variety, and are reasonably uniform in every respect. The land also is as well suited to fertilizer tests as could be expected. With the assistance of Mr. J. F. O'Kelley and Prof. J. C. C. Price of the Main Station Staff at the A. & M. College, we selected a block of about 125 trees in this grove for the test. Plats are composed of four trees each and alternate rows used for accuracy. The test was repeated four times in the block. We used the formula 8-5-3, and plan to test the amount and time of application. No fertilizer was used on one plat, 25 pounds on the next, and 50 pounds on the third; then on other plats we applied 25 pounds in March and 25 pounds in June. All above applications were made per tree. Due to practically no crop on these trees this year, we secured no results from the test.

FERTILIZER TESTS

Tomatoes—A new test of fertilizers under tomatoes was started in 1925, comparing formulas which are most commonly used on South Mississippi soils. Amounts per acre are much larger than have been

heretofore used in our tests here with tomatoes. The work is being done on plats 1-35 acre in size, containing five rows each. The plats are duplicated with series II joining the end of series I, the order of plats being reversed in the former. Three rows of each plat were harvested, fruit being picked in the pink stage of ripening. The variety used for the test was Norton Wilt-Resistant. Plants were set 3 1-2 feet apart in rows 3 1-2 feet wide. Vines were trained on stakes and pruned. The table below gives the results of the first year's work with these tests. Although these figures may be indicative, to some extent, of the best way to fertilize for tomatoes, we do not feel that recommendations should be made.

TOMATO FERTILIZER RECORD FOR 1925

Acid Phos.	Nit. Sod.	Sul. Pot.	-- Formula	Increase Total	Increase No. 1	Gross Value	Cost of Fertilizer	Net Gain
600	300	200	8-4-8	5535.4	3889.6	$237.49	$18.53	$218.96
600	300	150	8-4-6	4386.2	2892.7	177.29	17.28	160.01
600	300	100	8-4-4	3643.1	2403.4	147.30	16.03	131.27
600	450	100	8-6-4	6456.1	3936.7	242.50	20.16	222.34
600	600	100	8-8-4	3364.0	1946.6	120.34	24.28	96.06
450	450	150	6-6-6	2446.9	1558.7	95.74	20.09	75.65
675	450	150	9-6-6	4284.7	2581.0	159.12	22.07	137.05
900	450	150	12-6-6	3320.5	2614.8	158.65	24.05	134.60
1200	600	200	8-4-4	4089.0	2750.2	168.36	32.06	136.30

(The increases in the above table are in pounds per acre)

Sweet Potatoes—New work was started in 1925 with fertilizers under sweet potatoes, the same being conducted on land leased for experimental work with various crops. Plants (draws) of the Nancy Hall variety were set out for this work, after the land had previously been thoroughly prepared and fertilizers applied, on June 11th and 12th. These were spaced 18 inches apart and the rows are three and one-half feet wide. Plats are 1-20 acre in size, containing six rows each, four of which were harvested and two discarded for accuracy. The plats are in triplicate. Below are figures showing results of this year's test, which, like the work with tomatoes, are too immature to warrant recommendations, while they may be taken as indicative of proper fertilizers for sweet potatoes.

SWEET POTATO FERTILIZER RECORD FOR 1925

Acid Phos.	Nit. Soda	Sul. Pot.	-- Formula	Yield in Pounds	Increase in Pounds
300	150	100	8-4-8	8770	195
300	150	75	8-4-6	9080	740
300	150	50	8-4-4	8540	435
300	150	25	8-4-2	7270	-30
300	150	0	8-4-0	6690	-40
300	300	50	8-8-4	6400	240
300	225	50	8-6-4	7310	1672
225	150	50	6-4-4	6740	1055
150	150	50	4-4-4	6650	917
600	300	100	8-4-4	6070	162
900	450	150	8-4-4	6710	675
1200	600	200	8-4-4	6670	507

Note:—The increase in the above table was obtained by subtracting the theoretical yield of the treated plats without fertilizer from the actual yield. This theoretical yield was obtained by dividing the difference between two adjacent checks by four. This proportional part was then used to compute a gradual increase or decrease from one check to the next.

Bulletin No. 233 December, 1925

Report From Holly Springs Branch Experiment Station For 1925

By C. T. AMES

Soy beans for forage, and planted in corn as a soil building project.

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

STATION STAFF

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K. C. LIVINGSTON .....Foreman, Delta Branch Station
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D. MAXWELL.....Foreman and Herdsman
MISS MARY ALICE LANIER.....Addressograph Operator
H. B. BROWN, Ph. D.....Collaborator
E. C. EWING, M. Sc.....Collaborator

*In Cooperation, Bureau of Animal Industry, U. S. Dept of Agr.
....**On leave.

Holly Springs Branch Experiment Station
1925

The work of the Holly Springs Branch Station has been continually along the line towards the development of successful and progressive agriculture for this section of the State. More work was planned and executed this year than at any time in the history of the Station. The effect of this work can be very plainly seen on the farms of this section, and the crops produced. While the dry summer had much to do with the large cotton crop produced, fertilizers, close spacing, cultural methods, etc., also played a most important part. No doubt a much larger quantity of fertilizer will be used in the future. The effect of the use of fertilizer this year has been very convincing. The weather at planting time in the spring was very dry, and stands were secured with difficulty. The summer was extremely dry, not enough rain to allow grass to grow. The latter part of the fall was very wet causing the destruction of considerable cotton all over the State. The corn and hay crop was greatly reduced by the drought.

The weather conditions almost completely controlled the Boll Weevil this year. Very little damage occurred in North Mississippi even after the rains began in the fall, except on low lands.

Co-operative fertilizer tests were made at Durant. The Station supervised the applying of fertilizers and picking, and the cultivation was under farm management. Two sets of plots composed of 51 plots each were grown here the same as the cooperative tests. One set of these plots was on first class brown loam valley land. The second set was on thin table land near the Station. Cooperative plots were also planted at Sardis and New Albany. Poor stands were secured and errors in picking made it necessary to discard these results.

A small tract of valley land was leased by the Station to be used in increasing seeds of desirable varieties of cotton and corn, and increase our scope in fight against the weevil.

Soil improvement has had our attention at all times. It has long been recognized that a fertile soil is the basis of successful agriculture and a poor soil is a curse to civilization. Almost every acre of land on the farm grows either a summer or winter legume each year. Special attention has been given to cotton spacing, and variety studies have been made on both hill and valley land. Variety studies have been made also with corn, sweet potatoes, soy beans, alfalfa, lespedeza, and vetch. Dairying, and pasture grasses have had their place in the year's work.

Soil Washing—Controlling surface water on the farms of the South is of first importance. It is practicing poor business methods to attempt to build up land by the growing of legumes and the use of

farm manures, without first checking soil washing. After nineteen years' work on soil reclaiming projects on waste land in most instances, we can truthfully say that allowing surface water to go uncontrolled, thus washing away soil fertility, is an unpardonable crime.

Increased production and the growing of a proper diversity of crops, including enough for farm needs, together with proper marketing facilities, are the principal needs of the State.

A normal year we can grow on some of our soil, two bales of cotton per acre. The farm averaged one bale per acre this year including unfertilized plots and unimproved leased lands. Controlling surface water and the growing of legumes, will to a great extent account for this yield.

COTTON

The requirements for growing cotton successfully in the future are: a fertile soil, the judicious use of fertilizer and boll weevil poison, together with proper cultural methods adapted to the several cotton growing sections. We are of the opinion that there is enough information available on growing cotton under boll weevil conditions to warrant the statement that if this information should be put into practice, the South would grow more cotton than ever before in spite of the weevil. Those who have acquired this information have profited. We have never seen the public in more of a receptive mood than at present and we predict great strides in the near future. If the South will feed herself in this undertaking she will make true progress.

Preparation and Cultivation—In the hill section on account of soil washing during winter, we recommend that all the vegetable matter possible be left on the land as a protection and that these lands not be prepared until spring for cotton. Sod land should be turned in the fall or winter and left rough. Valley land may be prepared for cotton during the fall and winter if water is properly controlled on the land, otherwise but little is gained. On rolling land unprotected by terraces and where every row has more fall than it should have, soil washing will be increased by fall plowing. We will give only two ways to prepare and fertilize land for cotton. Where two furrows are turned together, or listed, it is a common practice to apply the fertilizer on this list by hand or with a fertilizer distributor. The middles are then thrown out and the land harrowed just prior to planting. The other method is to prepare the land in rows, open the rows and distribute the fertilizer, covering with a harrow. If possible apply the fertilizer a week or ten days prior to cotton planting, otherwise planting can be done just behind the fertilizer distributor.

Seed Bed—A well prepared seed bed that has been settled by rain is ideal. When the fertilizer can be applied a week or ten days ahead of planting, the frequent rains that usually prevail in the spring will give a firm seed bed. In case of dry weather, use the roller after planting.

Width of Row—For fertile valley land, three and one-half foot rows are sufficient. On thin upland, three foot rows are very satisfactory.

Time of Planting—Cotton planting time in this latitude is usually between April 25th and May 10th. The past two seasons the planting time was earlier than indicated. Plant cotton when the ground is warm enough to cause quick germination.

It appears that the time changes going South from this place at the rate of about twenty miles per day, that is, the planting time one hundred miles south of here on the Columbus and Greenville Railroad is about April 20th or five days earlier. When cotton is planted earlier than date given, nine years out of ten a poor stand is secured and as a result, a second planting is necessary late in May. The past year, earlier planting succeeded better than dates recommended. This is the case about one year out of ten. It is far better to plant medium early and secure a good stand than plant early and get a poor stand. Early planting is necessary and a good stand is essential. Late planting and poor stands are both very unsatisfactory, often causing a failure in the crop. The easiest way to increase a cotton crop from twenty-five to fifty per cent without one cent of additional cost is to get a good stand of cotton.

A Stand of Cotton—On hill land a stand of cotton is from three to four stalks of cotton in bunches per foot, on valley land two to three stalks in bunches per foot. It appears that about the only excuse for thinning cotton at all is to be able to use the hoe freely. Blocking the cotton out, leaving the blocks twelve to fourteen inches apart, is not very far from good spacing. The best results with close spacing of cotton can only be obtained by the use of a properly balanced fertilizer. Cotton seed should be planted very shallow and in medium elevated rows. It is advisable to use about one and one-half bushels of seed per acre. A good practice is to run the planter twice down a row using about three pecks of seed each trip. The first trip will plant the seed a little deeper than the second trip; this method will increase the chances for a stand.

Fertilizers—See recommendations under fertilizer experiments.

Varieties—See recommendations under variety studies.

Cultivation—Cultivation should begin as soon as the plants are established sufficiently not to be injured. Thin or block out as soon as possible and give frequent shallow cultivation.

Early Poisoning—Calcium arsenate applied in the bud of the cotton just as the squares begin to show, if any weevils can be found, or about the time the earliest squares are about half grown will kill the weevil. Either the sweet poison or the dust form will do the work. If labor is plentiful, use a mixture of one pound of calcium arsenate, one gallon of black strap molasses and one gallon of water applied with a mop or otherwise to the bud. If labor is scarce, use calcium arsenate dust from a hand or power machine. A second ap-

plication ten days later should be made if any weevils can be found. From our results, it appears that all of the weevils are out of hibernation and in the field by the time of the second application even on the earliest planted cotton. These two applications will probably control the weevils on thin upland assisted by dry weather. On valley land it may be necessary to continue poisoning. Aft r there is a ten percent infestation, use calcium arsenate dust as recommended by Mr. Coad, or, what is known as the Government Method, which is, make three applications of dust poison about four days apart and after this hold the weevil to about a twenty per cent infestation until the cotton quits growing by additional applications of poison. Our boll weevil circular is available at the office of the Experiment Station, A. & M. College, Mississippi.

TABLE NO. 1 VARIETY COTTON VALLEY LAND TEST, 1925

No.	Variety Used	Total Yield Seed	Lint				Total Value	Rank in
		Cotton Per Acre	Per Cent	Lbs. Per Acre	Length	Value Per Lb.	Per Acre	Money Value
1	Trice, Miss. Sta.	1744.45	29.4	516.87	1 1-16	20.83	132.21	17
2	Trice, Burdette	1851.67	30.6	566.61	1 1-16	20.83	143.72	14
3	Wannamaker Big Boll	1486.25	36.0	535.05	7-8	18.00	115.33	25
4	Cleveland Piedmont	1633.10	32.9	537.29	1	19.33	125.78	20
5	Cleveland Coker	1169.45	35.4	413.98	1	19.33	95.13	26
6	Cleveland 54	1550.12	33.3	516.19	1f	19.75	122.63	23
7	Half and Half	1398.97	41.7	583.37	7-8	18.00	121.32	24
8	Cook 1010	1463.40	39.7	580.95	15-16	18.53	125.30	21
9	Willis	2193.03	33.0	723.70	1 1-16	20.83	180.14	8
10	Miller	2484.79	32.8	815.01	1 1-8	22.50	216.77	1
11	Acala	2076.57	35.2	730.95	1 1-16	20.83	180.17	7
12	Mexican Big Boll	2049.10	34.2	700.79	1 1-16	20.83	172.94	10
13	D. & P. L. No. 4	2063.20	36.1	744.81	1 1-16f	21.25	184.64	6
14	Lone Star 65	2089.21	33.1	691.53	1 1-8f	23.67	191.63	2
15	Salsbury	1544.60	30.8	475.76	1 1-8	22.50	129.43	19
16	Webber Deltatype	1738.38	29.8	518.03	1 5-16	32.00	190.17	3
17	Delfos 631	1862.37	31.1	579.26	1 1-4	28.33	189.76	5
18	Delfos 911	1798.43	31.3	562.91	1 3-16	25.33	158.18	12
19	Delfos 6102	1885.71	31.2	588.34	1 3-16	25.33	174.98	9
20	D. & P. L. No. 5	1591.04	30.8	490.04	1 1-4f	29.67	167.41	11
21	Express Lightning	1544.12	28.8	444.71	1 3-16	25.33	134.64	16
22	Express 432	1407.24	31.7	446.09	1 1-8f	23.67	124.81	22
23	Mahon's Half and Half	1597.11	39.9	637.25	7-8f	18.33	136.01	15
24	Haaga's 68	1862.86	33.6	626.02	1 1-16	20.83	155.14	13
25	D. & P. L. No. 8	1883.04	37.3	702.37	1 1-8f	23.67	189.86	4
26	Haaga's 86	1507.40	31.0	467.29	1 1-8f	23.67	131.41	18

VARIETY TEST WITH COTTON.

These tests were made, one on hill and the other on valley land. Each test was in one row plots repeated four times. The season was extremely dry from early spring until late fall. The latter part of the season was extremely wet. Plantings were made about the middle of April. All land had to be rolled to secure a stand which was

not had until about the middle of May. The hill land test was on brown loam table land of average fertility. The valley land test was on fertile soil.

Tables No. 1 and No. 2 give the results.

TABLE NO. 2 VARIETY COTTON HILL LAND TEST, 1925

No.	Variety Used	Total Yield Seed Cotton Per Acre	Lint				Total Value Per Acre	Rank in Money Value
			Per Cent	Lbs. Per Acre	Length	Value Per Lb.		
1	Trice, Miss. Sta.	1555.97	32.2	501.02	1 1-16	20.83	124.46	8
2	Trice, Burdette	1288.95	31.4	404.73	1 1-16	20.83	101.98	22
3	Wannamaker Big Boll	1186.90	38.1	452.21	7-8	18.00	96.09	25
4	Cleveland Piedmont	1333.69	35.6	374.79	15-16	18.53	83.64	26
5	Cleveland Coker	1265.19	37.1	469.38	15-16	18.53	102.90	21
6	Cleveland 54	1343.48	35.6	478.28	1	19.33	111.75	18
7	Half and Half	1255.40	44.4	557.40	13-16f	17.33	110.56	19
8	Cook's 1010	1312.72	40.4	530.34	7-8f	18.33	112.86	17
9	Willis	1521.02	34.6	526.27	1	19.33	121.62	12
10	Miller	1356.06	34.4	466.48	1 1-16	20.83	113.96	16
11	Acala	1391.01	36.6	479.11	1 1-16	20.83	118.04	14
12	Mexican Big Boll	1330.90	35.4	471.14	1 1-16	20.83	115.33	15
13	D. & P. L. No. 4	1402.19	37.2	521.61	1 1-16f	21.25	128.45	7
14	Lone Star 65	1481.88	35.2	521.62	1 1-8	22.50	136.57	4
15	Salsbury	1459.51	32.4	472.88	1 1-16f	21.25	120.23	13
16	Webber Deltatype	1198.09	30.2	361.82	1 1-4f	29.67	124.08	9
17	Delfos 631	1472.09	32.4	478.56	1 3-16f	26.42	146.31	1
18	Delfos 911	1439.94	32.4	466.54	1 3-16	25.33	137.64	3
19	Delfos 6102	1511.24	32.5	491.15	1 3-16	25.33	144.81	2
20	D. & P. L. No. 5	1213.46	33.5	406.51	1 1-4	28.33	131.30	6
21	Express Lightning	1349.07	30.1	406.07	1 3-16	25.33	121.72	10
22	Express 432	1385.42	33.8	458.27	1 1-8	22.50	121.65	11
23	Mahon's Half and Half	1242.82	41.8	519.49	7-8	18.00	107.98	20
24	Haaga's 68	1207.87	34.5	416.72	1f	19.75	98.12	24
25	D. & P. L. No. 8	1544.79	38.4	593.20	1f	19.75	136.19	5
26	Haaga's 86	1221.85	38.5	470.40	7-8f	18.33	101.25	23

Remarks—The difference between the prices of long staple and short staple cotton in 1923 was very little. In fact, staple cotton was a drag on the market. This caused a swing back to short cotton in 1924; that year there was a difference of about 6 cents per pound in favor of staple cotton. This year, 1925, the difference between the price of short and staple cotton has been about 6 cents in favor of staple cotton. Some of the strong growing medium early varieties came to the front this year. The long growing season no doubt was in their favor.

Conclusion—The five year average in varieties (tables Nos. 3 and 4) should assist in making selections of varities.

Lone Star 65 came first in the valley land test in 1923, the wettest year on record, and came second this year 1925, the driest year on record. This variety should attract more attention. It is a good storm cotton, dwarf, big boll, early variety.

COTTON VARIETY TEST, FIVE YEAR AVERAGE, 1921 TO 1925

There is no doubt that the careful selection of a variety of cotton and the judicious use of the proper fertilizer will add to the income of the growers more than anything else under their control.

The following tables give a five year average of some of the leading varieties of cotton grown at Holly Springs.

TABLE NO. 3 VARIETIES GROWN ON VALLEY LAND

	Pounds of Lint Cotton Per Acre							
Years	Delfos 6102	Lone Star 65	Delfos 631	Webber Delta	Miss. Sta. Trice	Acala	Miller	Cleveland 54
1921	797.1	741.2	683.9	667.3	675.3	717.5	803.3	849.1
1922	269.9	259.9	192.5	112.0	224.6	293.7	249.1	214.4
1923	408.7	460.1	360.1	286.8	408.0	324.0	317.0	420.4
1924	515.6	456.0	443.7	355.2	493.2	420.8	404.2	435.4
1925	588.3	691.5	579.2	518.8	516.8	730.9	815.0	516.2
Average	515.9	521.8	451.9	388.0	463.6	494.7	517.7	487.0
Value	$168.15	$163.53	$158.05	$142.74	$138.10	$138.10	$136.39	$124.89
Length	1 3-16	1 1-8	1 1-4	1 1-4f	1 1-16	1 1-16	1 1-16	1
Percent	31.1	32.5	30.9	29.4	30.6	35.1	32.3	33.7

Additions:- (9) Half and half 534.8 average lint, $122.75 Value, 41.1%
(10) Pied. Cleveland 472.6 average lint, 118.50 Value, 33.2%
(11) Cook 468.1 average lint, 108.64 Value, 37.3%
(12) Cleveland Wan. 461.8 average lint, 107.86 Value, 35.7%

TABLE NO. 4 COTTON VARIETIES GROWN ON HILL LAND

	Pounds of Lint Cotton per acre								
Years	Delfos 631	Delfos 6102	Lone Star 65	Acala	Miss. Sta. Trice	Webber Delta	Cook	Half & Half	Miller
1921	488.5	491.8	468.0	479.7	437.6	491.8	680.3	612.3	493.4
1922	220.3	226.9	225.3	233.9	255.4	132.6	230.1	287.4	221.7
1923	241.6	230.9	299.4	261.3	256.2	155.7	252.5	240.7	202.5
1924	346.3	364.9	332.2	417.3	355.2	266.7	396.1	414.7	408.7
1925	478.6	491.2	521.6	479.1	501.0	361.8	530.3	557.4	466.5
Average	355.1	361.1	369.3	378.9	361.1	281.9	417.9	422.5	358.5
Av. Value	117.30	113.97	107.07	104.99	103.99	98.59	97.04	95.79	92.88
Av. Percent	32.7	32.8	33.9	36.9	32.1	31.2	38.9	41.8	34.5

Additions:- (10) Cleveland Piedmont Av. Pounds 364.7, Value $91.02, Percent 35.
(11) Cleveland 54 Av. Pounds 367.4, Value $90.99, Percent 35.2
(12) Cleveland Wan. Av. Pounds 344.6, Value $78.24, Percent 37.0

Remarks—There are several new varieties of promise that could not be included in these tables.

The long growing hot dry seasons with but few boll weevils, brought to the front this year some of the strong medium early maturing varieties.

Conclusions—Any variety of cotton that will stand near the top in money value for a five year average is a good variety to plant.

It appears that staple varieties can be grown on both hill and valley land if soil is good and the proper fertilizers are used. However, as a rule, it is better to grow short staple varieties of cotton in the hill section or on the thinner lands and staple varieties on valley land. There is but little change in the standings of the varieties whether grown on hill or valley land, as can be seen in the table. Lone Star 65 ranked first in 1923, the wettest year on record and second this year, the driest year on record. This variety should be planted more extensively in the hill section. It is a good storm cotton, dwarf in growth, big boll, early and prolific.

COTTON SPACING TESTS

Soils—For hill test, brown loam table land. For valley test, fertile brown loam.

Plots—Four rows each, for hill test 1-9 acre each. For valley test, 1-12 acre each.

Planted—April 23 and April 21, 1925.

Fertilized—All plots were fertilized at the rate of 500 pounds per acre with the following mixture: 200 pounds acid phosphate, 100 pounds nitrate soda, and 100 pounds kainit.

TABLE NO. 5 HILL SPACING TEST

Plants per foot in drill	Yield of seed cotton per acre
5.07	1707.13
2.57	1492.01
1.98	1569.11
1.24	1537.36
.76	1405.85
.59	1106.54

TABLE NO. 6 VALLEY SPACING TEST

Plants per foot in drill	Yield of seed cotton per acre
5.82	1896.0
3.41	1890.0
2.35	1722.0
1.62	1650.0
.82	1524.0
.67	1392.0

Remarks—The extremely dry season practically without weevils, gave what might be called a normal cotton growing season. An attempt was made to use the following spaces in the row: unthinned, to be left as it came from the planter, three stalks in bunches per foot, two stalks per foot, one stalk per foot, one stalk per 18 inches, and one stalk per 24 inches. The tables give the actual distances used.

COOPERATIVE FERTILIZER TEST

Conducted by the Holly Springs Branch Station in conjunction with County Agents, Chamber of Commerce and good farmers.

Similar plantings were also made on the Station on both valley land and slightly rolling hill land. The plantings made at Sardis and New Albany were spoiled in picking and had to be discarded. The planting at Durant was on the farm of Mr. Claud McClelland and was worked by J. W. Johnson, colored. Mr. R. L. Rigby, and Mr. H. O. Jones, Secretaries of the Chamber of Commerce at Durant, gave very able assistance, Mr. H. O. Jones making the last picking for the Station.

Soil—The test at the Station was on improved valley land that has grown legumes each year for the past 15 years and acid phosphate and nitrogenous fertilizers have been used each year. The hill land test was on unimproved leased land.

TABLE NO. 7 RESULTS OF FERTILIZER TEST CONDUCTED AT HOLLY SPRINGS ON VALLEY LAND—1925

Pounds of material applied to the acre			--	Pounds seed cotton per acre		Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Formula - -	Yield	Increase	Increase at 7 cts.	Cost of fertilizer	Net gain
No fertilizer				1560.8				
300	150	100	8-4-8	1995.8	435.0	30.45	9.27	21.18
300	150	75	8-4-6	1876.6	315.8	22.11	8.65	13.46
300	150	50	8-4-4	2146.8	586.0	41.02	8.02	33.00
No fertilizer				1560.8				
300	150	25	8-4-2	1798.7	237.9	16.65	7.40	9.25
300	150	none	8-4-0	1730.8	170.0	11.90	6.77	5.13
300	300	50	8-8-4	1921.5	360.7	25.25	12.14	13.11
No fertilizer				1560.8				
300	225	50	8-6-4	2036.2	475.4	33.28	10.08	23.20
225	150	50	6-4-4	2031.6	470.8	32.96	7.36	25.60
150	150	50	4-4-4	1983.8	423.0	29.61	6.70	22.91
No fertilizer				1560.8				
600	300	100	8-4-4	2334.8	774.0	54.18	16.04	38.14
900	450	150	8-4-4	2299.5	738.7	51.71	24.06	27.65
1200	600	200	8-4-4	2044.8	484.0	33.88	32.08	1.80
No fertilizer				1560.8				

Note:—The materials applied to the last three fertilized plots supply approximately as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.

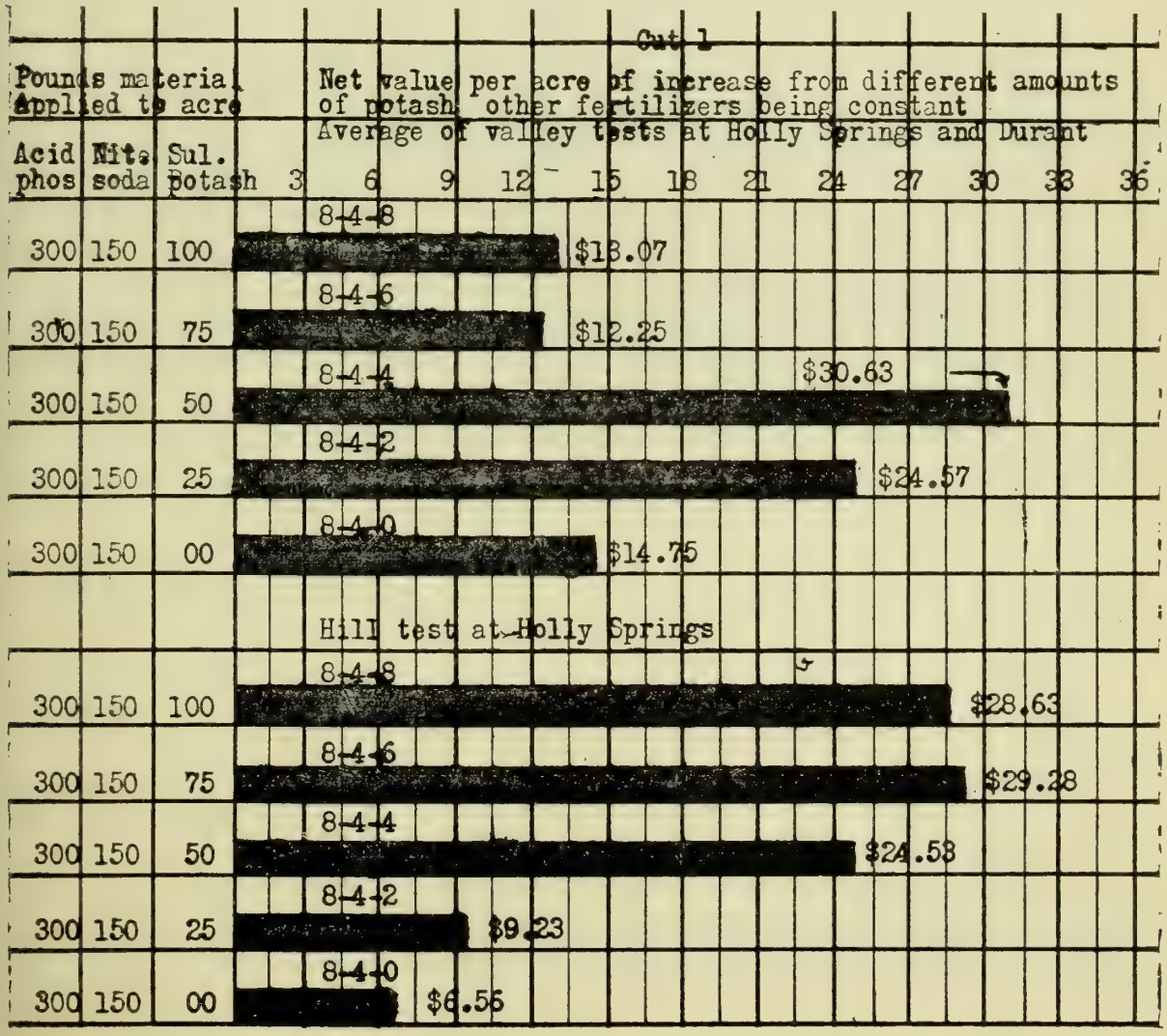
Dates of Planting—Valley land on Station, April 21, 1925; hill land plots, April 18, 1925; at Durant, April 17, 1925.

Varieties—Delfos 6102 was used on all plots except the hill land test; these plots were planted to Mississippi Station Trice.

Plots—All plots were 1-20 of an acre each in size, planted in three series. Only the middle rows were used in the test. The valley land planting did not germinate until after the middle of May.

TABLE NO. 8 RESULTS OF FERTILIZER TEST CONDUCTED AT HOLLY SPRINGS ON HILL LAND—1925

Pounds of material applied to the acre			-- --	Pounds seed cotton per acre		Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Formula --	Yield	Increase	Increase at 7 cts.	Cost of fertilizer	Net gain
No fertilizer				679.8				
300	150	100	8-4-8	1221.2	541.4	37.90	9.27	28.63
300	150	75	8-4-6	1221.6	541.8	37.93	8.65	29.28
300	150	50	8-4-4	1144.8	465.0	32.55	8.02	24.53
No fertilizer				679.8				
300	150	24	8-4-2	917.4	237.6	16.63	7.40	9.23
300	150	none	8-4-0	870.2	190.4	13.33	6.77	6.56
300	300	50	8-8-4	972.0	292.2	20.45	12.14	8.31
No fertilizer				679.8				
300	225	50	8-6-4	952.0	272.2	19.05	10.08	8.97
225	150	50	6-4-4	943.3	263.5	18.45	7.36	11.09
150	150	50	4-4-4	961.1	281.3	19.69	6.70	12.99
No fertilizer				679.8				
600	300	100	8-4-4	1302.1	622.3	43.56	16.04	27.52
900	450	150	8-4-4	1480.7	800.9	56.06	24.06	32.00
1200	600	200	8-4-4	1664.9	985.1	68.96	32.08	36.88
No fertilizer				679.8				


Cut 1
Pounds material applied to acre
Acid phos
Nit. soda
Sul. potash
Net value per acre of increase from different amounts of potash, other fertilizers being constant
Average of valley tests at Holly Springs and Durant
3 6 9 12 15 18 21 24 27 30 33 36
300 150 100 8-4-8 $13.07
300 150 75 8-4-6 $12.25
300 150 50 8-4-4 $30.63
300 150 25 8-4-2 $24.57
300 150 00 8-4-0 $14.75
Hill test at Holly Springs
300 150 100 8-4-8 $28.63
300 150 75 8-4-6 $29.28
300 150 50 8-4-4 $24.53
300 150 25 8-4-2 $9.23
300 150 00 8-4-0 $6.56

The graphs in cut No. 1 represent one year's work only. They show the net value per acre increase from the use of different amounts of potash, other fertilizers remaining constant.

The upper graph gives the average of the test on valley land at Holly Springs and Durant. See table No. 10.

The lower graph gives net value per acre on hill land at Holly Springs. See table No. 8.

TABLE NO. 9 RESULTS OF COOPERATIVE FERTILIZER TEST CONDUCTED AT DURANT—1925

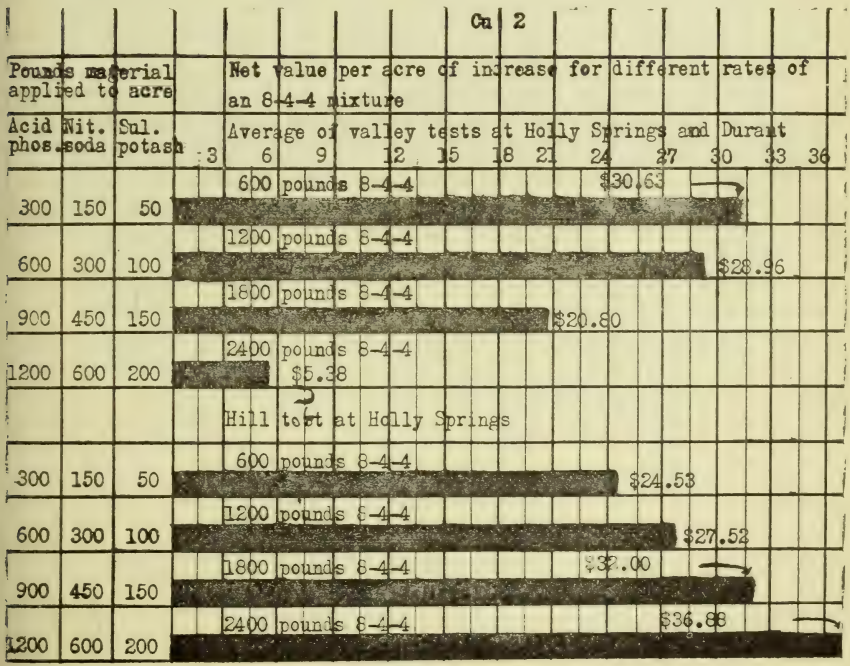
Pounds of material applied to the acre			-- --	Pounds seed cotton per acre		Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Formula - -	Yield	Increase	Increase at 7 cts.	Cost of fertilizer	Net gain
No fertilizer				1366.0				
300	150	100	8-4-8	1571.9	205.9	14.41	9.27	5.14
300	150	75	8-4-6	1647.3	281.3	19.69	8.65	11.04
300	150	50	8-4-4	1884.6	518.6	36.30	8.02	28.28
No fertilizer				1366.0				
300	150	25	8-4-2	2072.0	706.0	49.42	7.40	42.02
300	150	none	8-4-0	1827.3	461.3	32.29	6.77	25.52
300	300	50	8-8-4	1854.2	488.2	34.17	12.14	22.03
No fertilizer				1366.0				
300	225	50	8-6-4	1959.8	593.8	41.57	10.08	31.49
225	150	50	6-4-4	1913.9	547.9	38.35	7.36	30.99
150	150	50	4-4-4	1880.6	514.6	36.02	6.70	29.32
No fertilizer				1366.0				
600	300	100	8-4-4	1880.5	514.5	36.02	16.04	19.98
900	450	150	8-4-4	1911.7	545.7	38.20	24.06	14.14
1200	600	200	8-4-4	1946.6	580.6	40.64	32.08	8.56
No fertilizer				1366.0				

Note:—The materials applied to the last three fertilized plots supply approximately as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.

TABLE NO. 10 AVERAGE RESULTS OF FERTILIZER TESTS CONDUCTED AT HOLLY SPRINGS AND DURANT—1925

Pounds of material applied to the acre			-- --	Pounds seed cotton per acre		Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Formula - -	Average	Increase	Increase at 7 cts.	Cost of fertilizer	Net gain
No fertilizer				1463.4				
300	150	100	8-4-8	1782.6	319.2	22.34	9.27	13.07
300	150	75	8-4-6	1761.9	298.5	20.90	8.65	12.25
300	150	50	8-4-4	2015.6	552.2	38.65	8.02	30.63
No fertilizer				1463.4				
300	150	25	8-4-2	1920.1	456.7	31.97	7.40	24.57
300	150	none	8-4-0	1770.8	307.4	21.52	6.77	14.75
300	300	50	8-8-4	1884.1	420.7	29.45	12.14	17.31
No fertilizer				1463.4				
300	225	50	8-6-4	1995.8	532.4	37.27	10.08	27.19
225	150	50	6-4-4	2022.5	559.1	39.14	7.36	31.78
150	150	50	4-4-4	1932.0	468.6	32.80	6.70	26.10
No fertilizer				1463.4				
600	300	100	8-4-4	2106.2	642.8	45.00	16.04	28.96
900	450	150	8-4-4	2104.2	640.8	44.86	24.06	20.80
1200	600	200	8-4-4	1998.6	535.2	37.46	32.08	5.38
No fertilizer				1463.4				

Note:—The materials applied to the last three fertilized plots supply approximately as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.



The graphs in cut No. 2 give only one year's results of net value per acre of increase for different rates of an 8-4-4 mixture. The upper graph gives average of valley land at Holly Springs and Durant. (See table No. 10). The lower graph gives results on hill land at Holly Springs. (See table No. 8).

Remarks—We wish to stress the point that the above results shown in the four graphs represent this year's work only.

It appears that potash to some extent has been beneficial in the valley land and Durant tests (table No. 10) but the six and eight percent applications are much out of line.

In the hill land test, table 8, potash appears to be very beneficial even as high as six percent.

In the upper part of Cut 2 giving different rates of 8-4-4 mixture, it appears that as the amount is increased above 600 pounds on the Holly Springs valley and Durant test, the profit decreases. We do not consider this out of line as the valley land used has grown legumes for the past sixteen or seventeen years and has had fair applications of phosphorus each year. Water supply was the limiting factor here. The land at Durant 125 miles south of here, is good level land that has been pastured for the past eight years and did not suffer so much for water.

The hill land test (table No. 8) profits increased as the amount of fertilizer increased. The profit with 1000 pounds of fertilizer was $27.52; with 1500 pounds of fertilizer it was $32.00; with 2000 pounds of fertilizer it was $36.88.

Fertilizer Recommendations—Taking into consideration our past results at the Station and at various points in North Mississippi, we find no marked difference in the fertilizer requirements in this part of the State. The outstanding fact is that both phosphorus and nitrogen are deficient, and we believe potash to some extent, and that a liberal amount of a complete fertilizer will increase the yield of cotton very materially.

The cotton farmer in this section should use a mixture of 200 pounds phosphoric acid and 100 pounds nitrate of soda with 100 pounds of kainit (or 25 pounds sulphate or muriate of potash) where there is a tendency for cotton to rust. This mixture should be applied at the rate of 400 to 600 pounds to the acre. An 8-4-4 ready mixed fertilizer can be used instead of this home mixture provided the greater part or all of the nitrogen is from a readily soluble source.

Results indicate that on the average soil of North Mississippi as much as 1000 pounds of a well balanced fertilizer will pay better than the lesser amounts recommended provided the fertilizer is judiciously used and the crop is well cared for. Results also indicate that where the soil has been materially improved by the use of legumes, and other farm practices excellent yields can be obtained without any enormous investment in expensive fertilizers.

FERTILIZER TEST ON FINLEY FIELD—1925

Soil—Very thin brown loam of somewhat uneven fertility. This land has been in cultivation for fifty or more years without having ever been planted to restorative crops of any kind. This is the fourth year these plots have been used. Results in 1923 and 1924 were so poor that they were not published. This type of land is similar to thousands of acres in this section.

Plots—Were 1-23.84 of an acre each, composed of seven rows and planted in four series. Three series were planted to cotton. Rows were three feet wide.

Planted—April 24 to Cleveland Wannamaker Cotton.

TABLE NO. 12 COTTON FERTILIZER TEST—1925

Pounds of material applied to the acre				Pounds seed cotton per acre		Dollars per acre		
Acid phos.	Nitrate of soda	Cotton S. Meal	Kainit	Average	Increase	Increase at 7 cts. lb.	Cost of fertilizer	Net gain
No fertilizer				656.5				
250	100	200	100	1522.7	981.3	68.69	11.08	57.61
250	100	200	75	1393.9	967.5	67.72	10.92	56.80
250	100	200	50	1180.1	868.8	60.82	10.76	50.06
No fertilizer				196.2				
250	100	200	0	1060.9	855.3	59.87	10.60	49.27
150	100	200	75	945.7	730.7	51.15	10.04	41.11
350	100	200	75	1041.8	817.4	57.22	11.80	45.42
200	100	200	75	934.5	700.7	49.05	10.48	38.57
No fertilizer				243.2				
250	50	200	75	961.5	698.4	48.89	9.56	39.33
250	150	200	75	1339.8	1056.8	73.98	12.28	61.70
250	0	200	75	915.5	612.7	42.89	8.17	34.72
250	100	0	75	1025.1	702.4	49.17	5.42	43.75
No fertilizer				342.6				
300	100	200	100	1393.9	1047.7	73.34	11.52	61.82
300	100	200	75	1322.4	972.6	68.08	11.36	57.72
300	100	200	50	854.2	500.7	35.05	11.20	24.85
300	100	200	0	1137.9	780.8	54.66	11.04	43.62
No fertilizer				360.7				

Note:—The pounds increase in the above table was obtained by subtracting the assumed yield of all treated plots without fertilizer from the actual yield. The assumed yield without fertilizer was obtained by assuming a gradual increase or decrease from one check to the next.

NITROGEN SOURCES TEST

Soil—Unimproved sandy loam valley land.

Plots—Size 1-20 acre each, consisting of four rows each, forty inches wide and 164 feet long. Only the two inside rows were used in the test.

Planted—April 18.

Variety—Mississippi Station Trice.

TABLE NO. 11. NITROGEN SOURCES TEST—1925

Pounds of material applied to the acre	Pounds seed cotton per acre		Percent increase	Dollars increase in value at 7c
	Yield	Increase		
No fertilizer	1742.3			
150 Nitrate soda	1989.4	247.1	14.18	17.30
112.5 Ammonium sulphate	1944.4	202.1	11.60	14.15
88 Ammonium nitrate	1987.2	244.9	14.06	17.14
No fertilizer	1742.3			
105 Calcium cyanamid	1893.4	151.4	8.69	10.60
173 Calcium nitrate	2074.4	332.1	19.06	23.25
48.9 Urea	1960.9	218.6	12.55	15.30
No fertilizer	1742.3			

Note:—All plots including the checks had an addition of 300 pounds acid phosphate and 50 pounds of sulphate of potash per acre in order that deficiencies in these would not render the nitrogen comparisons worthless. Each nitrogen carrier was applied at such a rate as to supply 22.5 pounds available nitrogen per acre.

CORN

All of the corn grown at the Station is after some legume, principally vetch. As a rule, early planting on thin land is advisable. The seasons are more favorable about the time corn begins to fruit than they are when later plantings are made. When plantings are made earlier than the latter part of April, the results are usually a poorer stand. When the soils have an abundance of vegetable matter, earlier plantings can be made with safety. Thin land is a poor place to grow corn. Our method is to turn the land planted to crimson clover about the time blooming begins. Disk the land thoroughly and after a rain, harrow and plant on a level. On land where vetch is grown, after some of the seed have matured, the vetch is removed for hay and the land turned, disked, harrowed, and planted. Usually land in vetch has sufficient moisture in it to permit immediate planting after preparation. The planting should follow very closely to preparation. One good rain after the land is turned to settle down the soil, almost insures a good crop of corn. This work is done usually the first half of June.

We advise planting beans, Otootan, Laredo or Virginia soy beans, in every row of corn. If it is a dry year, the yield of corn will be reduced to some extent, but the two crops are much more valuable than corn alone. It is a good practice to plant two rows of corn and one row of velvet beans. If the same number of stalks are left on

the two rows of corn as would be left if all three rows were planted to corn, the yield will be reduced but little. This method will build up the land and at the same time give larger yields each year from the land. The Laredo or Otootan soy bean will stand more water than corn. Unsafe wet lands can be planted to either of these beans and corn and if the corn is drowned out the beans will make a crop. Much of the wet lands of the country are being planted to one of these varieties of beans for forage. Beans planted in the same row with corn will keep down weeds and grass to some extent and shade the ground during the summer.

Three or four beans dropped every 12 to 15 inches will give satisfactory results. If necessary a planter dropping the beans can be run behind the corn planter in the same row with the corn. If corn is not planted until after danger of frost, the beans will germinate about as well as the corn.

Planting and Cultivating—Corn should be planted very shallow in the spring and on a well prepared seed bed. We prefer wasting seed corn in order to insure a good stand. About seventy-five per cent of the farmers do not put down enough seed to insure a stand of corn. Where a forty-two inch row is used, on average land, one stalk every thirty inches is about the right distance. As land increases or decreases in fertility, the distance should vary. The more fertile the land, the more closely the corn can be grown and the thinner the land, the wider the distance should be. It is easy to leave too much corn in the land for the best results. Thin land should be planted to a legume and not to corn; more feed will be secured by such a method.

Where deep cultivation is practiced it should begin when the plants are small and should be kept up at frequent intervals. This method is more applicable for early plantings. For June planting, medium shallow cultivation is advisable. Four or five cultivations on the later plantings are usually sufficient for good results. Run the cultivator about the same depth at each cultivation, regardless of the method used.

VARIETY CORN TEST

Plots—One row each planted in checks, repeated eight times; rows 3½ feet apart, and 130 feet long.

Date of Planting—May 15, 1925.

Fertilizer Used—Two hundred pounds of acid phosphate and 150 pounds of nitrate of soda, after turning under a good sod of crimson clover. Moisture was the limiting factor this year.

TABLE NO. 13

Variety	Yield in bushels per acre	Percent of Grain	Rank
Mosby Station	59.87	73.6	8
Mosby Delta	63.51	73.6	3
Mosby Lee	58.10	71.6	9
Mosby Suttle	52.82	80.0	12
Cocke's Prolific Station	62.57	73.2	4
Cocke's Prolific Delta Station	60.75	74.2	7
Hastings	73.97	76.7	1
Delta Prolific	61.17	79.4	6
Jelli Course Twins	64.00	69.2	2
Laguna	53.41	68.3	11
Paymaster H. Springs	53.98	69.2	10
Paymaster	62.09	70.6	5
Ellis	50.80	67.2	13
Yellow Dent Fer.	42.13	72.5	16
Yellow Dent Station	44.62	70.7	15
Large Yellow Dent	50.76	67.2	14

Remarks—The soil on which this test was conducted was highly improved and the yield was low on account of dry weather. The variety Jelli Course Twin came out second the past two years. This is a tall growing, medium size, white eared variety. The seed were secured from the Knoxville Tennessee Experiment Station.

VARIETIES OF CORN, FIVE YEAR AVERAGE—1925

Years	Neal's Paymaster	Hasting's Prolific	Mosby College	Cocke's Delta	Cocke's Station	Laguna
1921	43.71		46.55	35.78	39.52	38.44
1922	76.22	53.92	55.56	56.15	54.53	48.63
1923	79.51	72.80	64.73	72.81	72.51	63.62
1924	68.77	43.02	50.35	51.79	56.70	49.93
1925	62.09	73.97	59.87	60.75	62.57	51.20
Average	66.06	60.92	55.61	55.66	57.16	51.20

Remarks—It will be noted that Hasting's Prolific test was for 4 years.

Recommendations—Any of the above varieties are good. Neal's Paymaster has been in the lead at this Station for the past three years until this year. Some objection is found to this variety by some growers. It is a large red cob, two eared variety that is hard to beat. Jelli Course Twin is a new tall growing variety that came second for the past two years and has only been in the test two years. This variety was secured from the Knoxville, Tenn., Experiment Station. This promises to be fine for silage and grain.

CORN FERTILIZER TESTS—1925

Soil—Unimproved sandy loam valley land that has been subject to overflow.

Plots—Size 1-20 acre each duplicated.

Planted—April 15, 1925.

Variety—Neal's Paymaster.

TABLE NO. 15 CORN FERTILIZER TEST—1925

Pounds of material applied to the acre	Bushels per acre		Increase at $1.05	Cost of fertilizer	Net gain
	Yield	Increase			
Check	18.84				
100 Nitrate soda	23.78	4.94	5.19	2.75	2.44
100 Nitrate soda					
200 Acid phosphate	24.22	5.38	5.65	4.51	1.14
Check	18.84				
100 Nit. soda at planting					
100 Nit. soda first working	28.68	9.84	10.33	5.50	4.83
100 Nit. soda					
200 Acid phos. at planting					
100 Nit. soda first working	28.65	9.81	10.30	7.26	3.04
Check	18.84				
200 Acid phos.					
200 Nit. soda	31.38	12.54	13.17	7.26	5.91
Check	18.84				
200 Nit. soda					
400 Acid phos.	30.30	11.46	12.03	9.02	3.01
150 Ammonium suluphate					
400 Acid phos.	25.14	6.30	6.62	8.77	−2.15
Check	18.84				
150 Ammonium sulphate	27.29	9.48	9.95	10.27	−0.32
150 Ammonium sulphate					
400 Acid phos.					
200 Kainit	28.32	8.45	8.87	5.25	3.62
Check	18.84				

Remarks—There was a very marked benefit in the early growth of the corn from the use of a mixture of acid phosphate and nitrogen combined. The lack of moisture was the controlling factor. Ordinarily this land should have given a very much increased yield.

Recommendation—Based on former results, we recommend the use of a mixture of 150 pounds acid phosphate and 100 pounds nitrate of soda or 75 pounds sulphate of ammonia per acre at planting. It will pay in most instances to apply as a side dressing, from 50 to 100 pounds of nitrate of soda, after first working.

Very frequently side dressings of nitrogen are made too late for the best results. On soils that have had liberal applications of acid phosphate for several years prior to planting corn, the additional application of phosphorus may not be necessary. A fertile soil is best for corn. Plant soy beans in your corn and improve the fertility of your soil.

TABLE NO. 14. CORN AND BEAN TEST

	Yield in bushels per acre	
	1923	1925
1. 6 Rows of corn	48.2	45.9
2. 6 Rows of corn with Soy beans	45.5	37.25
3. 6 Rows of corn with Velvet Beans	31.3	31.9
4. 6 Rows; 2 rows corn 1 row soy beans	42.5	37.5
5. 6 Rows; 2 rows corn 1 row velvet beans	40.2	34.2

Remarks—Extreme dry weather prevented a much larger yield.

Conclusions—Plant beans in corn, either in every row or in every third row. The two crops will more than equal corn alone. It is not advisable to plant velvet beans in every row with corn, a wet year (1923) the beans will destroy the corn. A season when rains are plentiful the yield of corn will be reduced but little even if soy beans are planted in the same row with corn. This method will keep up soil fertility besides giving an increased amount of forage and grain.

Silage—Sweet sorghum planted alone or in the same row with corn, gives very satisfactory results. We have found Japanese Seed Ribbon Cane a most excellent variety for this purpose. This sorghum produces at least one third more tonnage per acre on any land than corn and has very near the same feeding value ton for ton. Sorghum has other advantages. Dry seasons, like the past year, sorghum will stand the drouth better, and at harvest time the sorghum will not damage if harvesting is delayed, which is not the case with corn. Corn blooms but once and if the weather is unfavorable during this period, the results will be very poor. Sorghum will wait for rain and will recuperate after the rain. The one thing to be guarded in sorghum, it must be mature to make a good grade of silage. Immature sorghum will make sour silage which is very undesirable. If sorghum is planted with an (small size) eight hole corn plate in the planter, the seed will be dropped in bunches about twelve inches apart and hoeing may not be necessary if cultivation is properly done. Sorghum grown thick in this way will produce smaller stalks which are more desirable for feed.

Fertilizers—When such heavy tonnage is to be removed from the land a liberal amount of fertilizer should be used. Six or eight hundred pounds of an 8-4-4 mixed fertilizer would give good results. If the weather gets very dry, the addition of 100 pounds nitrate of soda as a side dressing would pay. On fertile soil a good season, from fifteen to twenty tons of silage per acre could be expected. The average is about ten tons per acre. Some have found it satisfactory to plant corn with sorghum in the same row. This method was a failure on the Station this year. If a mixed corn and sorghum silage is desired, they can be planted separately and mixed at the cutter. We have been unable to find a substitute for dairy cows that is more profitable.

SWEET POTATOES

Variety and Spacing Test

Soil—Slightly rolling brown loam hill land.

Plots—Duplicated 1-20 acre each.

Variety—Nancy Hall.

Seed Selection and Treatment—Use only clean sound potatoes free from diseases. Potatoes grown from vine cuttings on land free from diseases give desirable potatoes for growing plants. Sound potatoes taken from among black rot infested potatoes can be used for seed if soaked 10 minutes in a solution composed of one ounce of of bicholride of mercury to eight gallons of water. All seed potatoes should have this treatment, it matters not how clean they appear.

Beds—Convenience for watering should have much to do with the location, also the beds should be on land where no potatoes have been grown for the past five years. If it becomes necessary to use the same beds each year, the soil should be removed and all parts of the beds disinfected with a solution of copper sulphate, one pound to twenty gallons of water. A wooden vessel should be used in making the solution.

TABLE NO. 16 SWEET POTATO VARIETY TEST

Variety Used	Average Yield in Bushels					
	1921	1922	1923	1924	1925	Five Year
Nancy Hall	198.7	150.4	142.9	217.3	225.7	187.0
Triumph	271.8	178.8	195.2	224.5	230.3	209.3
Porto Rican Yam	278.8	191.4	133.3	135.2	250.4	197.8
Dooley Yam	200.2	125.1	177.1	178.6	294.1	195.0

TABLE NO. 17 SWEET POTATO SPACING TEST

Space used	Average Yield in Bushels		
	1923	1925	Two Year
7 Inches in drill	206.2	186.6	196.4
14 Inches in drill	170.9	167.2	169.0
21 Inches in drill	154.5	151.8	153.1

The only satisfactory way we have found for growing plants is in hot beds, the heat supplied by stable manure or artificially. If stable manure is used the method we employ is to dig a pit about twelve inches deep and five feet wide and as long as desired. Green moist stable manure is placed in piles in the pit and allowed to remain until hot; the time required being about two days. After heating, the manure is spread evenly over the bottom of the pit about twelve inches deep and well packed by tramping. Cover the manure at once with about six inches of top soil. If the soil is dry it can be packed firmly. The potatoes are then placed close together without touching and covered about 2 1-2 inches deep with sand or woods dirt. A hot bed of this kind should not be made until ready to use. If covered with glass or canvas, better results will be had, as the bed can be protected from cold rains. This type of hotbed is common over the country. Bottom heat may be supplied from a furnace or some other method.

A common method is to dig a trench about ten inches wide and twelve inches deep in the middle of the bed. This trench should have a rise of not less than one foot to twenty five feet in length. The lower end of the trench is widened out and deepened to be used as a furnace. Old tin or sheet iron is placed over the trench the entire length and six inches of soil is put on the sheet iron. The potatoes are bedded as described above. A chimney is made of one by twelve inch plank about eight feet long. The furnace is heated when desired. The advantage of this kind of heat is that it can be supplied only when necessary.

Soil for Planting—A clay or sandy loam is fine for potatoes. Most of the Station potatoes are grown after vetch is harvested from the land. Potatoes can be grown on thin soil but a much larger yield can be grown from the better type of land. Rows may be three or three and one half feet apart and plants about 14 to 16 inches apart in the row. Use about five hundred pounds of 8-4-4 mixed fertilizer or the same amount of the following mixture. 200 lbs. acid phosphate, 100 lbs. nitrate soda and 100 lbs. kainit or its equivalent in some other form of potash. The past year only early plantings were satisfactory. Usually the planting made about June 1st. is very satisfactory.

Harvesting Potatoes—Remove the vines with a hay rake or, a vine cutter may be used. In case of killing frost before digging, the vines should be removed within two or three days.

Two furrows with a double horse plow does good work in the absence of a potato digger. The greatest care should be used to prevent bruising. The potatoes should be assorted in the field and placed in baskets or boxes. This will facilitate handling and curing out in the curing house. It is through bruised or cut potatoes that diseases such as ring rot, storage rot, and other diseases are introduced. Such potatoes should be disposed of as soon as dug or stored separately.

Curing the Potatoes—Get rid of excessive water in the potato. This should be done as soon as dug. The curing house is a proper place for such work. If the weather is dry, open all ventilators, doors, and windows and allow air to circulate during the day and close up at night. Keep fires going in furnace or stove during the day. It usually requires about two weeks to dry out a small house. The thermometer should range around 80 degrees during the day to get the best results in curing the potatoes. Properly cured potatoes will stand four or five degrees below freezing without great damage, which is an item in marketing. The proper temperature for keeping a house during the winter is between 45 and 55 degrees; slight variations will not injure the potatoes.

The sweet potato could easily be one of North Mississippi's money crops. There is a good demand on nearby markets.

VETCH

Every land owner should be interested in maintaining soil fertility. The most practical way, after the surface water has been controlled, is to grow either summer or winter legumes. Any of the following legumes are fine: red clover, bur or crimson clover, velvet or soy beans, cow peas, lespedeza or vetch. Take your choice, but grow a legume on your soil every year if you can. It is profitable both to the producer and to the soil. More profitable crops are grown following the legumes without any additional cost. Most legumes can be grown as catch crops and in most instances cost but little more than the seeding. The hope of the South is increased production with less cost, and on less acres of land. This will in most instances necessitate increased soil fertility. The legume that produces well and is easily grown should be considered. Vetch is easily started on good land and if properly handled (allowed to seed once in two or three years) will remain indefinitely on the land and come up as a volunteer crop each fall after the cultivation of ordinary crops has ended. Vetch grows some in the fall but it makes its principal growth in March, April and early May. Hairy vetch has so far given best results at this Station, although smooth or common vetch does well and is about ten days earlier than the hairy vetch. Vetch is not unlike other plants; it does best on good fertile soil. Vetch does not do well a wet season or on wet land. Land on which barnyard manure has been scattered gives fine results. Use about ½ pound of soil from land growing vetch successfully, to each pound of seed, to furnish inoculation. If let alone vetch will mature seed about the latter part of May. The first crop should be turned under after seeding to secure a good quantity of seed for future crops. After the first year a hay crop can be removed after some of the seed have matured.

We have found the following two year rotation a most excellent method: Plant vetch seed, fifteen pounds per acre, in cotton middles in September and cover by using a cultivator of some kind. When fall rains begin the vetch will germinate and do some growing during the winter. Allow this to mature seed, turn the land and plant to corn, which will be in June. Plant the next year to cotton and allow the vetch to mature seed, follow with corn, etc. Land treated in this way will increase in production each year. A small addition of about two tons of limestone per acre will double the yield of vetch. The manure secured from stock fed to vetch hay if scattered on the land will give a most excellent seeding of vetch. This is one of the easiest ways to increase the area on the farm. We cultivated land this year that was seeded to vetch sixteen or seventeen years ago and now has a most excellent stand. Only one seeding has been made. This land will now make two bales of cotton and one hundred bushels of corn a good year for these crops. It is necessary to keep up the supply of phosphorous and potash to get the best results following vetch.

LESPEDEZA

Every effort in experimental work with lespedeza for the past two years has been practically destroyed by the extreme dry summers, fertilizer experiments and varied quantities of seed planted per acre, etc. In our reclaiming work on extremely poor soils, we found this plant the most satisfactory. It adapts itself to the soil on which it is planted from the poorest to the richest, but it is like other plants,—it does best on fertile soils. The addition of phosphorus at the rate of 500 lbs. of acid phosphate per acre has doubled the yield on uplands. Many of our friends have not fully realized what they have in this plant. Lespedeza is one of the greatest legumes ever grown in this country. As a forage crop there is none better as far as it goes. There is enough idle land growing, or that should be growing lespedeza in the State to furnish sufficient hay to feed all of the livestock in the State if harvested each year. There is no better quality of hay known. All open idle lands should be seeded to lespedeza as a soil improver if for no other purpose. A small quantity of seed sown on top of the ground in early Spring will soon furnish a perfect stand. The seed are usually allowed to be scattered through the manure of livestock but this method is too slow, considering the fact that a small quantity of seed sown per acre will furnish perfect seeding after the first year.

It is a common practice to sow fall oats and the latter part of March, section harrow the oats and seed to lespedeza using not less than 25 lbs. of seed per acre. After the oats are harvested, the lespedeza takes charge and produces a good crop under favorable conditions. The seed sell from $3.00 to $6.00 per bushel. Many sections of the country make the growing of seed for market one of their chief money crops.

The common method of preparing land for seeding is to disk the land diagonally across the rows and run the section harrow at right angles to the disk. This will about level the land. The seed should be sown on freshly harrowed soil in March and should not be covered. The weeds and grass should be clipped with a mower once or twice during the year to give the plants the advantage.

There are several machines and attachments for machines on the market for harvesting seed. A greater part of the seed on the market are secured in this way. After a light frost in the fall, the seed shatter out easily and are caught in pans attached to the machine. The thin soils and second growth after hay has been harvested, or pasture lands, are used for seed harvesting in most instances.

ALFALFA

In the variety test after the first cutting, the plantings were destroyed on account of poor stands. The seasons for the past three years have been extreme, either too wet or too dry. The fertile clay uplands or the well drained valley lands will grow alfalfa without any trouble if four or five tons of crushed limestone is used per acre. Soil to be seeded to alfalfa should be prepared at least 60 days prior to seed planting, the lime applied to the surface and harrowed in. Weeds and grass can be kept down by the use of a disk or section harrow. The soil should be firm at seed planting time. We have had better results with fall plantings. After a rain in September, we find a most desirable time to plant. Spring plantings can be made. Use from 20 to 25 pounds of seed per acre and cover with a section harrow. In our variety test we found that common alfalfa and Disco No. 12. gave best results. One acre or more near the home for hogs and poultry to furnish early grazing, will be found profitable. In the non-lime soil, Lespedeza and soy beans can take the place of Alfalfa as a forage crop on account of the absence of lime. However, soy beans are greatly benefited by the use of lime.

SOY BEANS

The following varieties were planted in a variety study test. Laredo, Otootan, Biloxi, Virginia, Mammoth Yellow and Wilson. Although the seasons were extremely dry the plantings on good soil made splendid growth. The fall rains practically destroyed the test. We were unable to secure satisfactory weights of hay or of the beans. Each of the above varieties have their place in Southern Agriculture. The Laredo, Otootan, and Early Virginia are very desirable varieties. The Otootan is very much later maturing than the other two varieties, but when planted early, will produce more forage per acre. These varieties do not shatter out very freely, if harvested at the proper time, which adds to their value. The Laredo and Virginia are desirable when hay is to be harvested before cotton picking begins. The above three varieties resemble each other in growth having small stems, making a fine quality of hay.

The Biloxi and Mammoth Yellow have a much coarser stem and are tall growing varieties. The Biloxi is very late in maturing but does not shatter out in harvesting. The Mammoth Yellow shatters out badly in harvesting and at present is the most widely known variety. All of the above varieties are abundant fruiters.

Soy beans can be planted in narrow rows or broadcast on good fertile soil, whether grown for seed or for hay. If a three foot row is used it only requires about one and one half gallons of seed to plant an acre of the following varieties. Laredo, Otootan, Virginia and Wilson. The seed of the Biloxi and Mammoth Yellow are larger and more seed are required. Soy beans will grow on land too wet or too dry for corn. Unprofitable wet farm lands do well in soy beans.

This fact when put into practice will enable thousands of acres of here-to-fore unprofitable lands to be made as profitable as any lands on the farm. When narrow rows are used about two cultivations are necessary. From 200 to 400 pounds of acid phosphate should be used per acre on the soils of this section. While all soy beans are legumes and are supposed to get a greater part of the nitrogen used from the air, it will be found that from 100 to 200 lbs. of nitrate of soda will add much to the growth of the beans. The small seeded varieties have a distinctive value, when grown on fertile soil, the seed that shatter out in harvesting, if disked in, will come up the following spring and produce a volunteer crop of beans. This is only true on good fertile soil. In many cases oats are sown after the beans are harvested and in disking in the oats, the beans are covered that were shattered out in harvesting. After the oats are harvested in June, the volunteer beans take charge of the land and make a wonderful hay crop, three to four tons per acre a good year. The most of our planting of Laredo beans this year was on thin land after oats. The extreme dry summer almost destroyed the hay crop. There are several sections of the country that are growing soy beans for seed purposes. In the past the beans have been mowed and raked as for hay and then thrashed. Many seed are lost in the process and besides it is expensive. There are now on the market, bean harvesters, both for single rows and for beans planted broadcast that thrash out the beans standing in the field. This is a great labor saving process and also a saving of seed. These harvesters are mostly horse drawn and do splendid work under proper conditions. They are not very expensive, from $175.00 to $250.00 according to the size. We like this method of harvesting also because only the beans are removed from the field. The plants left on the soil greatly improve the land. From 15 to 30 bushels of beans per acre is not an uncommon yield.

If every row of corn planted in the State was seeded to soy beans, it would furnish more forage and feed and add much to the fertility of the soil. There are many farms too poor to grow corn successfully. On such farms, soy beans could be used to profit taking the place of corn for the workstock in furnishing both forage and grain.

DAIRYING

The Station dairy at present bids fair to be one of the best in this section of the State. The season being extremely dry, it was necessary to feed silage and some grain all the summer. That means small profits. The grade cows of the herd were disposed of the past summer and registered cows from the Poplarville Station took their places. As soon as we can dispose of a few grades we now have on hand, only registered Jerseys will be held on the Station. From the beginning, the Station dairy was recognized as a necessity to furnish a market on the farm for legumes and other crops grown and to utilize the thin lands for grazing. How this section has es-

caped dairying for so long a time we are unable to understand. An attempt has been made to run the dairy so as not to interfere with regular Station work, leaving the experimental feature to the College herd at the A. & M. College of Mississippi. A good part of milk from the herd is sold locally at the dairy barn, and some cream is shipped on the butter fat basis. The skim milk is fed to the calves and poultry. This method interferes but little with regular farm work.

We have several projects in progress to be reported later to ascertain the value of cow manure measured in pounds of cotton or other crops, also a system of rotation including forage crops suited for dairy feed etc.

The dairy possibilities in this section are good. There is a cream and milk market within forty miles of any farm in North Mississippi. There are thousands of acres of idle land that could be made to grow feed and pasture, with but little expense. There are good cows that can be had in almost any sections without much effort. Cream separators can be had at almost your own terms. It is advisable for most people to start the dairy with the best cows at hand and cull out the poorer by keeping records and purchasing good ones in their places. There is idle labor on the farm half the year that has to be fed all the year. If the idle lands of this section are ever redeemed, the dairy cow and poultry will play an important part. The richest State in the Union has dairying as her chief industry. The South has everything in her favor, if we could be divorced from cotton—mild winters, cheap lands, cheap labor, long growing seasons. We can use inexpensive barns. Markets are also among the best of the country.

This Station has been using a milking machine for the past five years that has given good satisfaction. One man attends to twenty cows, milks and feeds, and maintains a sanitary dairy barn and milk house. Under ordinary conditions a milking machine will not be necessary with cheap farm labor plentiful. Any man that attempts to buy all feed for his dairy herd, will be obliged to get a fine price for milk if he stays in business long. We find a silo indispensable to our dairy, but with plenty of velvet beans grown in corn and plenty of lespedeza and soy bean hay, good results can be obtained without a silo. Dairying does not mean less cotton, but more fertile land on which to grow larger crops. Bermuda grass, lespedeza and white clover are the pasture plants for this section. A cow cannot manufacture a large quantity of milk without plenty of the right kind of material to do the work with.

In closing this report we wish to thank Director J. R. Ricks for the kind and pleasant way he has directed the work, also we wish to state that Mr. Harris F. Wallace and Mr. O. M. Ryan have assisted very materially in the success of the year's work. Mr. Otis B. Casanova relieved Mr. Wallace September 15, and has done good work.

SEED SOURCES, 1925

Cotton

Acala—L. E. Gleeck, Box 334, Memphis, Tenn.
Cleveland, Coker—Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Pied.—Piedmont Pedigreed Seed Farms, Commerce, Ga.
Cleveland, Wan.—Wannamaker-Cleveland Seed Farms, St. Matthews, S. C.
Cleveland 54—Miss. Exp. Sta., A. & M. College, Miss.
Cook 1010—D. N. Williamson Estate, Cedar Bluff, Ala.
D & P L No. 4—Delta and Pine Land Co., Scott, Miss.
D & P L No. 5—Delta and Pine Land Co., Scott, Miss.
D & P L No. 8—Delta and Pine Land Co., Scott, Miss.
Delfos 631—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 6102—Delta Branch Experiment Station, Stoneville, Miss.
Delfos 911—Delta Branch Experiment Station, Stoneville, Miss.
Express, Lightning—Pedigreed Seed Co., Hartsville, S. C.
Express 432—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Haaga 68—Oscar J. Haaga, Memphis, Tenn.
Haaga 86—Oscar J. Haaga, Memphis, Tenn.
Half & Half, Mahon—H. K. Mahon, Holly Springs, Miss.
Half & Half, Sum.—B. F. Summerour, Norcross, Ga.
Lone Star 65—Miss. Exp. Sta., A. & M. College, Miss.
Mex. Big Boll—Edgecombe Seed Breeders Assn., Tarboro, N. C.
Miller—Miss. Exp. Sta., A. & M. College, Miss.
Salsbury—Delta and Pine Land Co., Scott, Miss.
Trice, Burdette—Burdette Plantation, Burdette, Ark.
Trice, Miss. Sta.—Miss. Experiment Station, A. & M. College, Miss.
Webber, Deltatype, Pedigreed Seed Co., Hartsville, S. C.
Willis—Mrs. Stark Willis, Graysport, Miss.

Corn

Cocke's Prolific, Delta—Delta Branch Experiment Station, Stoneville, Miss.
Cocke's Prolific, Station—Miss. Experiment Station, A. & M. College, Miss.
Delta Prolific—Burdette Plantation, Burdette, Arkansas.
Ellis—Coker Pedigreed Seed Co., Hartsville, S. C.
Hastings—H. G. Hastings Co., Atlanta, Ga.
Jelli Course Twins—Tenn. Experiment Station, Knoxville, Tenn.
Large Golden Dent—Ullathorne Seed Co., Memphis, Tenn.
Mosby, Delta—Delta Branch Exp. Station, Stoneville, Miss.
Mosby, Lee—M. B. Lee, Corinth, Miss.
Mosby, Station—Miss. Experiment Station, A. & M. College, Miss.
Mosby, Suttle—J. E. Suttle, Louisville, Miss.
Paymaster—W. H. Neal, Lebanon, Tenn.
Paymaster, Holly Springs—Holly Springs Branch Exp. Station, Holly Springs, Miss.
Yellow Dent, Fer.—Ferguson Seed Farms, Sherman, Texas.
Yellow Dent, Sta.—Miss. Experiment Station, A. & M. College, Miss.

Bulletin No. 234 February, 1926

Cotton Fertilizer Experiments 1921-25

DELTA BRANCH STATION

By

W. E. AYRES

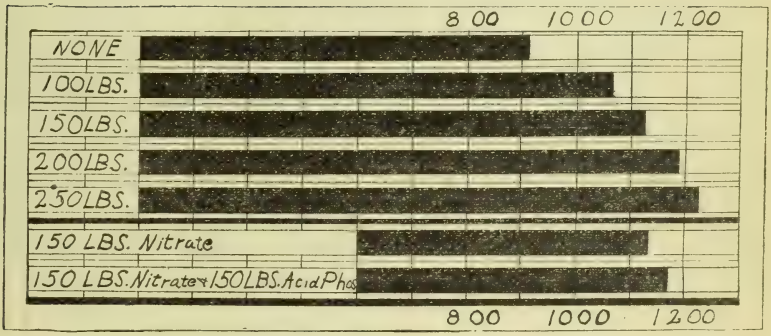


Fig. 1: Graph showing average yield of seed cotton per acre for varying amounts of Nitrate of Soda as an average of 37 tests throughout the Delta. The last two lines show average yields with 150 pounds of nitrate compared with 150 pounds of nitrate used with 150 pounds of acid phosphate in 29 tests.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

A. & M. College, Mississippi

J. R. RICKS, Director

STATION STAFF

B. M. WALKER, Ph. D. ..... President of College
M. H. MOORE ..... Secretary and Business Manager
J. R. RICKS, M. Sc. ..... Director and Chief in Agronomy
BEN F. HILBUN, B. Sc. ..... Agricultural Editor
E. B. FERRIS, M. Sc. .....Assistant Director, South Miss. Branch Station
C. T. AMES, M. Sc. ..... Assistant Director, Holly Springs Branch Station
W. E. AYRES, M. Sc. ....Asst. Dir. and Plant Breeder, Delta Branch Station
C. B. ANDERS** B. Sc. .....Assistant Director, Raymond Branch Station
H. F. WALLACE, B. Sc. .....Acting Asst. Director, Raymond Branch Station
S. W. GREENE* .....In charge of Costal Plains Branch Station
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J. S. MOORE, M. Sc. ..... Chief in Dairy Husbandry
R. W. HARNED, B. S. A. ..... Chief in Entomology
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C. F. BRISCOE, A. M., Ph. D. ..... Bacteriologist
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E. P. CLAYTON, ... Poultry Husbandman
W. C. MORSE, M. Sc. ..... Geologist
GEORGE S. TEMPLETON, B. Sc. ..... Chief in Animal Husbandry
J. C. C. PRICE, B. Sc. ..... Horticulturist
D. C. NEAL** B. Sc., M. A. ..... Plant Pathologist
LEWIS E. LONG, M. Sc. ..... Research Economist
J. F. O'KELLY, M. Sc. ..... Plant Breeder
C. J. GOODELL, B. Sc. ..... Associate in Animal Husbandry
H. W. ALLEN,** B. Sc., M. Sc. ..... Associate Entomologist
R. N. LOBDELL, M. Sc. ..... Zoologist
ROLAND COWART** B. Sc. ..... Asso. Agronomist
W. W. HULL, B. Sc. ..... Asst. Agronomist
H. A. YORK, B. Sc. ..... Asst. at Delta Branch Station
J. B. TURNER, B. Sc. ..... Asst. at Delta Branch Station
OTIS B. CASANOVA, B. Sc. ..... Asst. at Holly Springs Branch Station
W. S. ANDERSON, B. Sc. .....Horticulturist, South Miss. Branch Station
W. C. COWSERT, ... Assistant in Dairying
H. H. HARNED, M. S. ..... Associate Bacteriologist
MISS KITTIE SUE JOHNSON, A. B. ..... Secretary
MISS FANNIE PAGE ..... Stenographer.
D. W. McILWAIN ..... Superintendent of Farm
B. V. EVANS ..... Farm Foreman, South Miss. Branch Station
J. C. RYAN ..... Farm Foreman Holly Springs Branch Station
J. C. PEYTON ..... Foreman, Raymond Branch Station
K. C. LIVINGSTON ..... Foreman Delta Branch Station
F. O. CORK, B. Sc. ..... Supt. Farm Management Vocational Project
D. MAXWELL ..... Foreman and Herdsman
MISS MARY ALICE LANIER ..... Addressograph Operator
H. B. BROWN, Ph. D. ..... Collaborator
E. C. EWING, M. Sc. ..... Collaborator

*In Cooperation. Bureau of Animal Industry, U. S. Dept. of Agr.
**On Leave of Absence.

Cotton Fertilizer Experiments 1921-25

DELTA BRANCH STATION

BY W. E. AYRES

There was a time when Delta planters had no worry relative to soil fertility. In its virgin state the Delta was the richest section of the United States. Until 1913 periodic overflows replenished Delta soils so that really and truly most of the soils of the Delta were ever virgin. As late as 1920 many planters were free to advise the Station that time spent making fertilizer experiments was time wasted. Several progressive Delta planters, however, were using nitrogenous fertilizers profitably. Results in 1921 showed very clearly that Station soils were so deficient in nitrogen as to make nitrate of soda and other nitrogen carriers profitable. Cooperative fertilizer tests in several Delta counties indicated that other Delta soils, both loam and buckshot, were even more deficient in nitrogen than those on the Station farm.

Ten years ago fertilizer salesmen looked upon the Delta as their "desert." Now those who handle nitrogen look upon it as their "oasis." For the past three years the Yazoo Mississippi Delta has used more nitrate of soda than any other United States area of its size, devoted to the production of general field crops. For this reason the Station's soil fertility work has been so expanded that the acreage devoted to this work alone is more than double the total area devoted to all experiments in 1920. The work with commercial fertilizers for cotton has been given a very prominent place in the program.

METHODS

The plots consist of five one one-hundredth acre rows all treated alike, but records are taken on only the three inside rows of each plot. Every fourth plot is unfertilized. At least three series of plots are used and in the "Rates" experiment five series are used. The "New Sources" and the "Elimination" tests each have four series of plots. The figures given are averages of all series.

A very strong effort is made each year to obtain and keep a perfect stand on all plots. In hoeing the plots one person either hoes an entire series of plots or five persons are used so that the same person hoes the same row of every plot in the series. This aids materially in obtaining uniform treatment. No corrections have been made for stand because stands have been practically uniform.

"Corrected Yields" are obtained as follows: All check plots in a given test are averaged. The estimated yield of the fertilized plots, without fertilizer, is obtained by dividing the difference between the yield of the check plots by four and adding this common difference to the yield of the low yielding

check to obtain the "estimated unfertilized yield" of the fertilized plot adjoining it, etc. etc. Example: Plot 1 is unfertilized; plot 2 received 50 pounds nitrate per acre; plot 3, 100 pounds nitrate; plot 4, 150 pounds nitrate; and plot 5 is unfertilized. Plot 1 produced 1000 pounds of seed cotton per acre and plot 5 only 900 pounds. The difference is 100 pounds, 1-4 of which is 25 pounds. The "estimated unfertilized yield" of plot 4 is 925 pounds; of plot 3, 950 pounds; and of plot 2, 975 pounds. The actual yield of each fertilized plot of a given test is multiplied by the average of the unfertilized or check plots and this product divided by the "estimated unfertilized yield" of that plot to obtain the "corrected yield" of the plot. For fuller details see U. S. Department Bulletin No. 33.

This method of correction makes all "increases" comparable the same as if everything were reduced to the percentage basis. To the writer it is superior to other methods of comparison. A study of table 2 which gives both "actual" and "corrected" yields reveals considerable variations in "actual" yields of checks but a comparison of the 5 year averages of check plots shows that the "actual" and "corrected" yields of the checks are not far apart.

SOIL

The Station tests have been made on typical Deer Creek loam soil. The area is neither poor nor rich, but similar in age and native fertility to other land in the same class. It is as uniform soil as if often found.

The drainage is good and the preparation and cultivation the same. The plots on which table one gives data are rotated with corn, and oats followed by sorghum. The corn is fertilized the same as the cotton. Oats and sorghum are grown without fertilizer.

SOURCES OF NITROGEN FOR COTTON

As soon as it became evident that practically all old Delta soils were deficient in nitrogen the Station began experiments to determine the relative values of the various commercial nitrogen carriers. Average results and results of 1925 are given in table one. Table 2 shows "actual" and "corrected" yields for each year and the five year averages.

All materials were applied at such a rate as to add 15 pounds of nitrogen per acre in 1921 and 1922: 22.5 pounds in 1923 and 1924; and 30 pounds of nitrogen in 1925. The application was increased as other tests indicated that heavier applications were economical. The plot which received both meal and nitrate received half of the nitrogen from each. All fertilizers have been applied at planting time each year.

The five year average shows that ammonium sulphate and the combination of cotton seed meal and nitrate of soda have produced practically the same. At prevailing prices the ammonium sulphate has been considerably cheaper as a producer of cotton than the other materials. It is common knowledge that this material tends to make soils acid and that it has usually been found to produce no larger increases than nitrate of soda.

From what is known of the two materials and their actual performance on the Station it seems safe to recommend buying the one furnishing the cheapest nitrogen. Cotton seed meal alone has produced good returns but the price has been prohibitive as compared with nitrate of soda and ammonium sulphate. Like quantities of nitrogen in the latter two have cost only three-fifths to three-fourths as much as in cotton seed meal.

TABLE I Nitrogenous Fertilizers for Cotton 1921-25

SOURCE OF NITROGEN RATE PER ACRE TIME OF APPLYING	POUNDS SEED COTTON PER ACRE					PER CENT INCREASE	
	1925			AV. 1921-25			
	Actual Yield	Corrected Yield	Increase	Corrected Yield	Increase	1925	Average 1921 25
Sources of Nitrogen							
Check—No Fertilizer	2871.9	2779.4	------	1377.5	------	----	----
Nitrate of Soda	3141.4	3040.8	261.5	1551.1	173.6	9.41	12.60
Ammonium Nitrate	3227.5	3124.9	345.6	1589.2	211.7	12.43	15.37
Ammonium Sulphate	3274.7	3171.4	392.0	1616.2	238.7	14.10	17.33
Check—No Fertilizer	2869 2	2779.4	------	1377.5	------	----	----
Calcium Cyanamid	3227.5	3202.4	423.0	1488.9	111.4	15.22	8.09
Cotton Seed Meal	3169.1	3222.8	443.5	1579.1	201.6	15.96	14.64
One half Cotton Seed Meal One half Nitrate of Soda	3171.9	3308.0	528.7	1615 5	238.0	19.02	17.28
Check—No Fertilizer	2597.0	2779.4	------	1377.5	------	----	----
Rates of Applying Nitrate of Soda							
Check—No Fertilizer	2378.5	2604.0	------	1269.2	------	----	----
Fifty Pounds	2923.5	3060.3	456.3	1433.4	164 2	17.52	12.94
One Hundred Pounds	2956.8	2965 0	361.0	1479.0	209.8	13.86	16.53
One Hundred Fifty Pounds	3138.5	3020.3	416.2	1575.6	306.4	15.98	24.14
Check—No Fertilizer	2815.1	2604.0	------	1269.2	------	----	----
Two Hundred Pounds	3083.5	2903.0	298.9	1591.6	322.4	11.48	25.40
Two Hundred Fifty Pounds	3140.2	3009.8	405.8	1649.8	380 6	15.58	29.99
Three Hundred Pounds	3125.2	3050.6	446.6	1633.8	364.6	17.15	28.73
Check—No Fertilizer	2618.5	2604.0	------	1269.2	------	----	----
Time of Applying Nitrate of Soda							
Check—No Fertilizer	2905.3	2777.5	------	1402.0	------	----	----
At Planting Time	3266.3	3192.1	414.6	1586.9	184.9	14.93	13.19
At First Dirting	2958.0	2956.6	179.1	1570.0	168.0	6.45	11.98
At First Squares	3027.5	3096.4	318.9	1527.2	125.2	11.48	8.93
Check—No Fertilizer	2652.5	2777 5	------	1402.0	------	----	----
At First Blooms	2941.4	3044.9	267.4	1544.8	142.8	9.63	10.19
One half Planting One-half First Squares'	2996.9	3067.5	290.0	1603.9	201.9	10.44	14.40
One-half at Planting One-half at First Blooms	2980.3	3016.5	239.0	1534.6	132.6	8.60	9.46
Check—No Fertilizer	2774.7	2777.5	------	1402.0	------	----	----

Corrected Yields are based on average Yield of Check Plots.

In the first and second parts of table three some less common forms of nitrogen have been used. In the Special Fertilizer Test lime (or calcium) nitrate has been compared with nitrate of soda for three years. Nitrate of soda has increased the yield an average or 124.1 pounds of seed cotton per acre, while nitrate of lime only increased the yield 72.5 pounds. In the New Sources of Nitrogen Test in 1925 lime nitrate made a poor showing while Ammonium Sulphate showed up especially well. The extraordinary increase produced by compounds carrying nitrogen as a base and the less favorable showing made by those carrying nitrogen in the acid radical is uncommon. The causes are being sought.

Urea is a very concentrated Nitrogen Compound. The Nitrogen content ranges from 40 to 50 per cent depending upon the purity. It is readily available and promises strong competion for the other forms. It comes from Germany and is being sold under the trade name "Floranid".

In 1926 the Station will test another new nitrogen compound imported from Germany. It is a compound of Nitrate Nitrogen and Ammonium Nitrogen, being practically a mixture of Ammonium Nitrate and Ammonium Sulphate. It is sold as Leunasalpeter. The price is below nitrate of soda and Ammonium Sulphate. It contains 26 per cent of nitrogen. Since it is a synthetic product the nitrogen of which is taken from the air, the supply can be limited only by the demand. If it is anything like as efficient a fertilizer as the other compounds, Leunasalpeter promises much as a cheap source of nitrogen.

RATES OF APPLYING NITRATE OF SODA

In the spring of 1921 work was begun as indicated in table one to determine the most economical amount of Nitrate of Soda to apply. All Nitrate has been applied at planting time.

Average results for five years show that 50 pounds of Nitrate per acre has increased the yield 164.2 pounds of seed cotton; 100 pounds, 209.8 pounds; 150 pounds, 306.4 pounds; 200 pounds, 322.4 pounds; 250 pounds, 380.6 pounds; and 300 pounds of nitrate has increased the yield of seed cotton 364.6 pounds per acre.

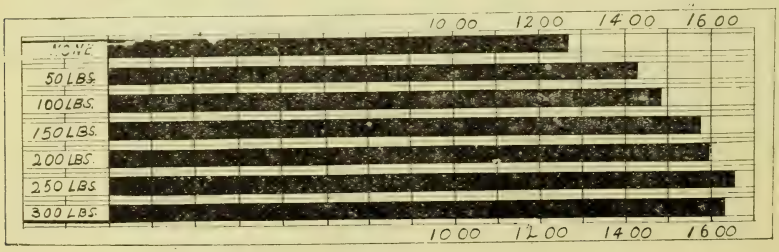


Fig. 2: Graph showing average yields of seed cotton for varying applications of nitrate of soda as an average of five years at the Delta Station.

TABLE II—Nitrogenous Fertilizers for Cotton, 1921 to 1925.

SOURCE OF NITROGEN RATE PER ACRE TIME OF APPLYING	POUNDS OF SEED COTTON PER ACRE					
	1921	1922	1923	1924	1925	AVERAGE
Sources of Nitrogen---Actual Yields						
Check—No Fertilizer	1428.0	803.3	564.4	1391.9	2871.9	1411.9
Nitrate of Soda	1699.0	857.7	727.8	1505.6	3141.4	1586.3
Ammonium Nitrate	1668.0	842.3	743.3	1623.7	3227.5	1622.0
Ammonium Sulphate	1717.0	906.6	757.8	1562.6	3274.7	1643.7
Check—No Fertilizer	1444.0	771.1	482.2	1428.7	2869.2	1399.0
Calcium Cyanamid	1482.0	768.8	528.9	1449.9	3227.5	1491.4
Cotton Seed Meal	1653.0	866.6	501.1	1609.3	3169.1	1559.8
½ C. S. M.—½ Nitrate of Soda	1663.0	855.5	695.5	1466.5	3171.9	1570.5
Check—No Fertilizer	1507.0	673.3	477.8	1355.4	2597.0	1322.1
Sources of Nitrogen---Corrected Yields						
Check—No Fertilizer	1459.0	749.2	508.1	1392.0	2779.4	1377.5
Nitrate of Soda	1731.0	807.9	679.9	1495.8	3040.8	1551.1
Ammonium Nitrate	1695.0	801.6	721.7	1602.6	3124.9	1589.2
Ammonium Sulphate	1740.0	871.6	765.8	1532.3	3171.4	1616.2
Check—No Fertilizer	1459.0	749.2	508.1	1392.0	2779.4	1377.5
Calcium Cyanamid	1481.0	771.4	553.5	1431.0	3202.4	1488.9
Cotton Seed Meal	1634.0	899.1	530.4	1609.2	3222.8	1579.1
½ C. S. M.—½ Nitrate	1627.0	918.7	737.9	1486.0	3303.0	1615.5
Check—No Fertilizer	1459.0	749.2	508.1	1392.0	2779.4	1377.5
Rates of Applying Nitrate of Soda---Actual Yields						
Check—No Fertilizer	1464.0	752.2	518.9	1253.3	2378.5	1275.2
50 Pounds	1511.0	842.2	671.1	1250.0	2923.5	1439.6
100 Pounds	1578.0	896.6	784.4	1231.7	2956.8	1489.5
150 Pounds	1677.0	946.6	847.8	1316.2	3138.5	1585.2
Check—No Fertilizer	1331.0	705.5	414.4	1147.9	2815.1	1282.8
200 Pounds	1666.0	947.7	911.1	1324.7	3083.5	1586.6
250 Pounds	1751.0	994.4	893.3	1400.0	3140.2	1635.8
300 Pounds	1664.0	1082.2	826.7	1363.7	3125.2	1612.4
Check—No Fertilizer	1357.0	741.1	437.8	1076.2	2618.5	1246.1
Rates of Applying Nitrate of Soda—Corrected Yields						
Check—No Fertilizer	1384.0	732.9	457.0	1167.9	2604.0	1269.2
50 Pounds	1461.0	833.7	622.3	1189.9	3060.3	1433.4
100 Pounds	1562.0	901.7	768.0	1198.2	2965.0	1479.0
150 Pounds	1702.0	967.4	879.5	1309.0	3020.3	1575.6
Check—No Fertilizer	1384.0	732.9	457.0	1167.9	2604.0	1269.2
200 Pounds	1723.0	972.2	890.7	1369.1	2903.0	1591.6
250 Pounds	1803.0	1007.6	958.1	1470.4	3009.8	1649.8
300 Pounds	1705.0	1083.2	874.5	1455.7	3050.6	1633.8
Check—No Fertilizer	1384.0	732.9	457.0	1167.9	2604.0	1269.2
Time of Applying Nitrate of Soda---Actual Yields						
Check—No Fertilizer	1640.0	611.1	513.3	1623.2	2905.3	1458.6
At Planting Time	1662.0	674.4	735.5	1804.3	3266.3	1628.5
At First Dirting	1661.0	693.3	671.1	1967.6	2958.8	1590.2
At First Squares	1627.0	733.3	528.9	1699.3	3027.5	1523.2
Check—No Fertilizer	1467.0	607.7	507.8	1663.7	2652.5	1379.7
At First Blooms	1639.0	688.8	605.5	1708.8	2941.4	1516.7
½ Planting—½ First Squares	1661.0	704.4	690.0	1804.8	2996.9	1571.4
½ Planting—½ First Blooms	1488.0	691.1	633.3	1707.5	2980.3	1500.0
Check—No Fertilizer	1429.0	656.6	450.0	1528.2	2774.7	1367.7
Time of Applying Nitrate of Soda—Corrected Yields						
Check—No Fertilizer	1512.0	625.1	490.4	1605.0	2777.5	1402.0
At Planting Time	1574.0	690.8	704.6	1773.0	3192.1	1586.9
At First Dirting	1616.0	711.1	644.6	1921.5	2956.6	1570.0
At First Squares	1629.0	753.3	508.0	1649.4	3096.4	1527.2
Check—No Fertilizer	1512.0	625.1	490.4	1605.0	2777.5	1402.0
At First Blooms	1700.0	694.5	601.8	1682.8	3044.9	1544.8
½ Planting—½ First Squares	1734.0	696.5	706.6	1815.1	3067.5	1603.9
½ Planting—½ First Blooms	1563.0	670.5	668.6	1754.4	3016.5	1534.6
Check—No Fertilizer	1512.0	625.1	490.4	1605.0	2777.5	1402.0

Sources and Time of Applying Rec'd 15 Lbs. Nitrogen per A. in 1921 and 1922; 22½ Lbs. in 1923 and 1924; and 30 Lbs. in 1925.

The net value of the increased yields after paying $60.00 per ton for Nitrate follow: Increase from 50 pounds of Nitrate per acre, $4.92; from 100 pounds, $17.98; 150 pounds, $26.14; 200 pounds, $26.24; 250 pounds, $30.56; and from 300 pounds only $27.46

The percentage return on the money invested in Nitrate up to and including 250 pounds per acre has been good. The safest and most paying rate for average conditions, however, is from 150 to 200 pounds per acre. If good farming is done there is little chance that 150 pounds of nitrate per acre will not pay well on all Delta soils which have been in cultivation ten years or longer.

Both "actual" and "corrected" yields for each year and the five year average are given in table 2.

Fig. 3: Left—Yield of 714 pounds seed cotton per acre with 150 pounds nitrate of soda. Center—No fertilizer, 220 pounds seed cotton. Right—946 pounds seed cotton per acre when 200 pounds of nitrate was applied in 1923 on loam soil.

TIME OF APPLYING NITRATE OF SODA

The time at which it is most economical and safest to apply nitrate has been studied by the Station for five years, also. The third section of table 1 gives 1925 and average data. The fifth and sixth sections of table 2 give the data by years.

Average results indicate that there is much danger of waiting too late to apply nitrate. All planters know that it is somewhat dangerous, because to apply nitrate all at planting time on a whole plantation. But everyone knows that anything which will make grass grow will also make cotton grow. No farmer would refuse to cultivate a rich field because it made the grass grow. This is about as logical as refusing to apply nitrogenous fertilizers early for the same reason. On the average the divided application—1-2 at planting and 1-2 at the second cultivation—has been the best. It is some the safest. The real danger lies in too late application. Those who are not sure the nitrate can be applied, as a side dressing, by the time the first squares appear without taking labor which is needed for cultivation, should apply it all before or at planting time, when there is a surplus of labor. APPLY NITRATE IN TIME.

TABLE III—Fertilizers for Cotton, 1923-24-25

FERTILIZER USED AND COMBINATION WHICH COTTON FOLLOWED	POUNDS SEED COTTON PER ACRE					PER CENT INCREASE	
	1925			AV. 1923-4-5			
	Actual Yield	Corrected Yield	Increase	Corrected Yield	Increase	1925	Av. 1923-25
Special Fertilizer Test							
None—Check	1798.5	1775.6	----	1188.5	----	----	----
Lime Nitrate—230 Lbs.	1804.0	1746.3	—29.3	1261.0	72.5	—1.65	6.10
Sodium Nitrate—200 Lbs.	1894.8	1799.0	23.4	1312.6	124.1	1.32	10.44
Acid Phosphate—200 Lbs.	1955.3	1821.6	46.0	1204.2	15.7	2.59	1.32
None—Check	1941.5	1775.6	----	1188.5	----	----	----
Sodium Nit. and Acid Phos. (3)	1856.3	1778.9	3.3	1324.7	136.2	0.19	11.46
Meridian 12 4 4—200 Lbs.	1831.5	1843.3	67.7	1313.2	124.7	3.81	10.49
Meridian 12 4 4 and Sod. Nit (3)	1837.0	1946.7	103.4	1457.4	268.9	5.82	22.63
None—Check	1586.8	1775.6	----	1188.5	----	----	----
New Sources of Nitrogen Test---30 Lbs. of Nitrogen per A.							
None—Check	2685.1	2773.6	----	------	----	----	----
Nitrate of Soda	2853.1	2900.0	126.4	------	----	4.57	----
Ammonium Sulphate	3023.3	3024.7	251.1	------	----	9.05	----
Ammonium Nitrate	2915.4	2871.6	98.0	------	----	3.53	----
None—Check	2859.4	2773.6	----	------	----	----	----
Calcium Cyanamid	2932.0	2864.7	91.1	------	----	3.28	----
Lime Nitrate	2720.3	2677.4	—96.2(1)	------	----	—3.47	----
Urea	2865.6	2841.4	67.8	------	----	2.44	----
None—Check	2776.4	2773.6	----	------	----	----	----
Elimination Fertilizer Test (2)							
Nitrate of Soda Alone	2898.8	2891.6	----	------	----	----	----
Nit. Soda and Acid Phos.	2851.1	2847.7	—43.9(1)	------	----	—1.52(1)	----
Nit. Soda, Acid Phos. and Sul. Potash	2849.0	2849.1	—42.5(1)	------	----	—1.47(1)	----
Nit. Soda and Sul. of Potash	3077.2	3081.1	189.5	------	----	6.55	----
Nitrate of Soda Alone	2884.3	2891.6	----	------	----	----	----
Residual Effect of Soybeans on Cotton (4)							
Corn 24 inch in Drill Alone	1693.8	1770.0	----	1635.1	----	----	----
Corn 24 inch and Otootans between Hills at Planting	2098.8	2154.4	384.4	2156.2	521.1	21.7	31.9
Corn 24 inch and Otootans between Hills 3 w'ks after Pl'ng	2021.3	2038.8	268.8	2128.2	493.1	15.2	30.2
Corn 24 inch and Otootans in Alternate Rows	2221.3	2202.3	432.3	2269.4	634.3	24.4	38.8
Corn 12 inch and Otootans in Alternate Rows	2190.0	2134.8	364.8	2176.1	541.0	20.6	33.1
Corn 24 inch in Drill Alone	1846.3	1770.0	----	1635.1	----	----	----
Average Increase	------	------	362.6	------	547.4	20.5	33.5

(1) Loss.

(2) Nitrate and Acid Phosphate each used at the rate of 300 pounds per acre and Sulphate of Potash at the rate of 75 pounds per acre.

(3) 200 pounds of each per acre.

(4) This test was only conducted in 1924 and 1925. The averages are for two rather than three years as indicated in the heading. No fertilizer used.

ARE PHOSPHATE AND POTASH NEEDED?

After the "Rates of Applying Nitrate of Soda" test had been carried for a few years, and it became evident that applications above 250 pounds per acre decreased the yield, phosphate and potash were suspected as being limiting factors after much nitrogen was added. For this and other reasons the "Special Fertilizer" test was begun in 1923. The first section of table 3 shows 1925 and average yields and increases.

As an average of three years 200 pounds of nitrate of soda in this test has increased the yields 124.1 pounds of seed cotton per acre. Two hundred pounds of both nitrate and acid phosphate only increased the yield 136.2 pounds of seed cotton per acre. The area on which the three series of this test is laid out is not as uniform as other experimental areas on the Station and results of less than five years are not wholly dependable.

The "Elimination" test is on uniform soil. Since it is only one year old results may contain considerable experimental error even in the average of the four series as published in section 3 of table 3. There seems no logical reason why nitrogen and potash should produce more than nitrogen, phosphorous, and potash, or that nitrogen and phosphorous should produce less than nitrogen alone.

Considering these and the cooperative tests and the experience and results of others, nitrogenous fertilizers used alone seem most economical for the Delta except along the foothills and on soils on which cotton either rusts or wilts badly. On the latter soils potash usually pays and both potash and phosphorous are needed on some of the eastern border of the Delta, where the soils are directly made from the adjacent hills.

SOYBEANS AS A NITROGENOUS FERTILIZER

For five years the Station has been planting a corn test in which soybeans are used in various ways. In 1923 the test was moved to a new location so that cotton might be alternated with it. Table 2, page 11, of bulletin 227 shows corn and soybean yields for four years. Table 3 of that bulletin shows cotton yields in 1924 on the 1923 area. Table 3, section 4, of this bulletin gives 1925 yields of cotton on the area which grew corn and soybeans in 1924,

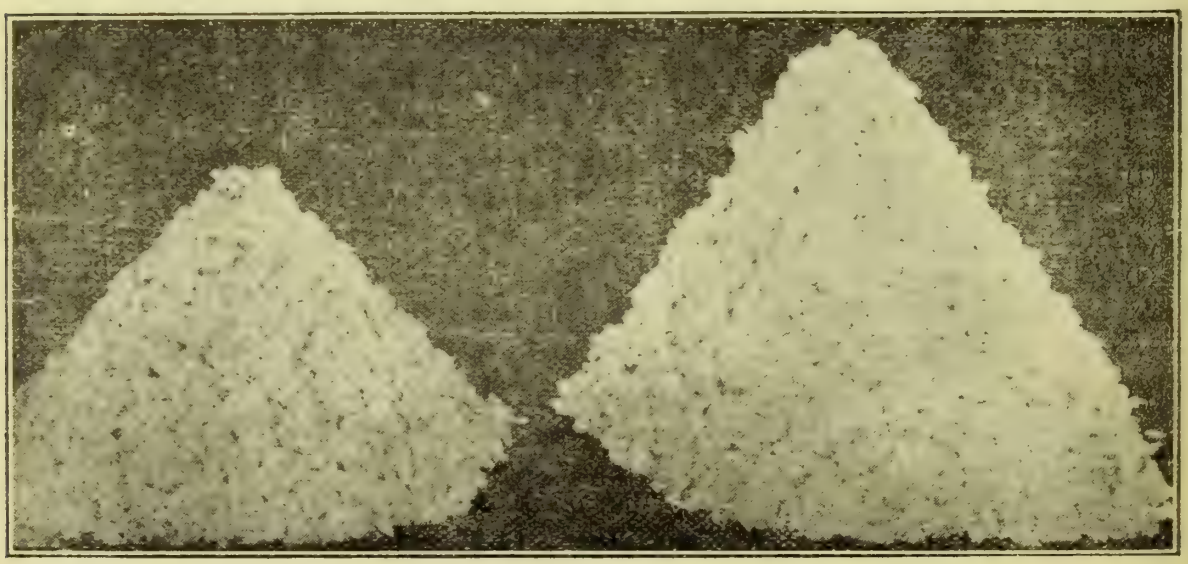


Fig. 4. Left, cotton grown in 1924 after corn alone in 1923 produced 1500.2 pounds per acre. Right, cotton on adjacent plots following corn and soybeans produced 2232.4 pounds per acre or 732.2 pounds per acre more. An increase of 48.8 per cent in the cotton yield the following year is some encouragement to plant soybeans in the corn.

and average cotton yields for 1924 and 1925. An average increase of 33.5 per cent in the cotton yield the first year, following a crop of soybeans should be an encouragement to farmers to plant more feed crops. The average increase, 547.4 pounds of seed cotton per acre, is as much cotton as is produced on many Delta acres, an average year. Soybeans can easily reduce both the feed and the fertilizer bill and increase the income from cotton.

COOPERATIVE FERTILIZER TESTS

In 1923 cooperative tests were begun with the County Agents and planters in the various Delta counties in order that planters might be able to see the various amounts of nitrogen and the combination of phosphorous and nitrogen used under uniform conditions and that the Station and Agents might have results of local tests to compare with those of the Station. Some of the local tests have not been as good as was hoped but the mass of Data now available is much more dependable than results of any one test over the same period.

Bolivar County: C. C. Smith, former County Agent, conducted the tests for which table 4 gives data in cooperation with the planters indicated and the Station. Average results given in section 1 of this table indicate that nitrate of soda has paid well in Bolivar County every year. It paid better in 1923, a wet year, than in either 1924 or 1925, both of which were dry. Moisture was one of the limiting factors in cotton production both years and the fertilizers did not have a chance.

An average of $14.81 worth of cotton for $3.00 worth of fertilizer; $21.48 worth of cotton for $4.50 invested in fertilizer; or even $25.70 in cotton for $6.00 invested in fertilizer for three years is enough to satisfy most investors. Here as at the Station from 150 to 200 pounds of nitrate per acre is safer than heavier applications.

One hundred fifty pounds of acid phosphate per acre used with the same amount of nitrate of soda increased the yield only 27.3 pounds of seed cotton per acre as an average of ten tests. In face of this Bolivar County men should spend no money for phosphate except as indicated previously.

Leflore County: Table 5 gives data for eight cooperative tests conducted in Leflore County by E. C. McInnis, County Agent, with the farmers indicated. At Morgan City and on the county farm acid phosphate has paid well. Elsewhere results with acid phosphate have been about the same as in other Delta counties.

As an average of these eight tests 100 pounds of nitrate of soda has increased the yield 137.4 pounds of seed cotton per acre; 150 pounds, 214.6 pounds; 200 pounds, 294.7 pounds; and 250 pounds gave an average increase of 356.3 pounds seed cotton per acre. Nitrogen has paid handsomely and, except the tests at Schlater, Leflore results are very consistent.

TABLE IV—Cooperative Fertilizer Tests in Bolivar County

KIND AND AMOUNT OF FERTILIZER PER ACRE	POUNDS OF SEED COTTON PER ACRE							
	1923		1924		1925		AVERAGE	
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
Average of All Tests								
None—Check	745.4	----	706.0	----	1446.6	----	981.8	----
100 Lbs. Nitrate of Soda	939.7	194.3	875.1	169.1	1536.9	90.3	1129.9	148.1
150 Lbs. Nitrate of Soda	1017.1	271.7	935.7	229.7	1601.2	154.6	1196.6	214.8
200 Lbs. Nitrate of Soda	1107.4	362.0	927.6	221 6	1656.1	209.5	1239.1	257.3
250 Lbs. Nitrate of Soda	1217.6	472.2	947.0	241.0	1596 6	150.0	1256.3	274.5
300 Lbs. Nitrate of Soda	------	----	954.1	248 1	1627.3	180.7	------	----
150 Lbs. Nitrate of Soda	817.6	----	947.0	----	1437.6	----	1117.4	----
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	879.7	62.1	934.0	—13.0	1487.9	50.3	1144.7	27.3
Alfred Gervin, Beulah, Buckshot Soil								
None—Check	454.4	----	409.4	----	723.6	----	529.1	----
100 Lbs. Nitrate of Soda	570 1	115.7	576.3	166.9	819.7	96.1	655.4	126.3
150 Lbs Nitrate of Soda	571.9	117.5	590.5	181.1	842.0	118.4	668.1	139.0
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	585.4	131.0	569.6	160 2	770.9	47.3	642.0	112.9
200 Lbs. Nitrate of Soda	630.0	175.6	503.9	94.5	1099.3	375.7	744.4	215.3
250 Lbs. Nitrate of Soda	670.2	215.8	493.5	84.1	765.3	41.7	643.0	113.9
300 Lbs. Nitrate of Soda	------	----	490 7	81.3	834.9	111.3	----	----
J. C. Brooks, Deeson, Buckshot Soil								
None—Check	813.0	----	683.9	----	------	------	748.5	----
100 Lbs. Nitrate of Soda	1022.7	209.7	993.0	309.1	------	------	1007.9	259.4
150 Lbs. Nitrate of Soda	1063.3	250.3	1099.9	416.0	------	------	1081.6	333.1
150 Lbs Nitrate of Soda and 150 Lbs. Acid Phosphate	1173.9	360.9	1028.5	344 6	------	------	1101.2	352.7
200 Lbs. Nitrate of Soda	1182.5	369.5	1049.2	365.3	------	------	1115.9	367.4
250 Lbs. Nitrate of Soda	1362.0	549.0	1140.6	456.7	------	------	1251.3	502.8
300 Lbs. Nitrate of Soda	------	----	1079.9	396.0	------	------	----	----
J. S. Gortner, Shelby, Buckshot Soil								
None—Check	------	------	635.1	----	1127.7	----	881.4	----
100 Lbs Nitrate of Soda	------	------	834.6	199.5	1295.6	167.9	1065.1	183.7
150 Lbs. Nitrate of Soda	------	------	890.8	255.7	1456.2	328.5	1173.5	292.1
200 Lbs. Nitrate of Soda	------	------	918.4	283.3	1538.0	410.3	1228.2	346 8
250 Lbs. Nitrate of Soda	------	------	917.1	282.0	1556.7	429.0	1236 9	355.5
300 Lbs. Nitrate of Soda	------	------	936.7	301.6	1592.1	464.0	1264 4	383.0
350 Lbs. Nitrate of Soda	------	------	1020.6	385.5	1425.5	297.8	1223.1	341.7
Sunflower Plantation, Merigold, Loam Soil								
None—Check	------	------	1143.7	----	882.2	----	1013.0	----
100 Lbs Nitrate of Soda	------	------	1096.2	—47 5	891.6	9.4	993.9	—19.1
150 Lbs. Nitrate of Soda	------	------	1163.7	20.0	890.5	8.3	1027.1	14.1
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	------	------	1268 5	124.8	876.6	—5.6	1072 6	59.6
200 Lbs. Nitrate of Soda	------	------	1248.0	104.3	791.8	—90.4	1019.9	6.9
250 Lbs. Nitrate of Soda	------	------	1194.4	50.7	825.1	—57.1	1009.8	—3.2
300 Lbs. Nitrate of Soda	------	------	1164.6	20.9	872.9	—9.3	1018.8	5.8

	Hugh Ivy, Shaw Loam Soil 1924		W. H. Myers, Cleveland Buckshot Soil 1923		J. F. Smith, (1) Cleveland Loam Soil 1925		Wm. H. Thomson Gunnison Buckshot Soil 1925	
None—Check	657.8	----	783.0	----	2164.0	----	2335.6	----
100 Lbs. Nitrate of Soda	875 5	217.7	1000.0	217.0	2311.5	147.5	2366.2	30.6
150 Lbs. Nitrate of Soda	933.8	276 0	1176.4	393.4	2255.4	91.4	2561.7	226.1
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	869.4	211.6	----	----	------	----	2765.9	430.3
200 Lbs. Nitrate of Soda	918.5	260.7	1241.0	458.0	2185.6	21.6	2647.0	311.4
250 Lbs. Nitrate of Soda	989.2	231.4	1268.2	485.0	2246.9	82.9	2553.8	218.2
300 Lbs. Nitrate of Soda	1098.8	441.0	----	----	2314.7	150.7	2688.5	352.9

(1) Ammonium Sulphate used to furnish equivalent amounts of Nitrogen in this test and on Sunflower Plantation in 19.5.

TABLE V—Cooperative Fertilizer Tests in Leflore and Coahoma Counties

KIND AND AMOUNT OF FERTILIZER PER ACRE	POUNDS OF SEED COTTON PER ACRE							
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
LEFLORE COUNTY								
	Jake Holland, Morgan City Sandy Loam Soil				**County Farm, Greenwood Sandy Loam Soil**			
	1923		1924		1924		1925	
None—Check	508.0	----	711.3	----	1140.8	----	1640.0	----
100 Lbs. Nitrate of Soda	697.3	189.3	972.0	260.7	1207.7	66 9	1682.9	42.9
150 Lbs. Nitrate of Soda	793.8	285.8	1080.4	369.1	1412.3	271.5	1598.9	—41.1
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	1136.6	628.6	1138.0	426.7	1625.1	484.3	1800.1	160.1
200 Lbs. Nitrate of Soda	876.1	368.1	1100.0	388.7	1485.3	344.5	1842.3	202.3
250 Lbs. Nitrate of Soda	1041.2	533.2	1111.9	400.6	1556.7	415.9	1833.3	193.3
300 Lbs. Nitrate of Soda	----	----	1122 7	411.4	1490 5	349.7	1911.8	271.8
	T. W. Wade Greenwood Buckshot Soil		**J. B. Dick Schlater Sandy Loam Soil**		**M. S. Cowsert Doddsville Sandy Loam**		**J. W. Mullen Itta Bena**	
	1923		1923		1924		1924	
0—Check	800.0	----	869.3	----	366.5	----	1364 1	----
100 Lbs. Nitrate of Soda	1088.4	288 4	855.2	—14 1	466.2	99.7	1501.5	137.4
150 Lbs Nitrate of Soda	1113.4	313.4	892.8	23.5	530.7	164.2	1612.2	248.1
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	1166.6	366 6	714.7	—154 6	----	----	1589.7	225.6
200 Lbs. Nitrate of Soda	914.5	314 5	991.4	122.1	674 5	308.0	1673.7	309.6
250 Lbs. Nitrate of Soda	1002 2	202 2	1072.5	203.2	934 8	568.3	1697 5	333.4
300 Lbs. Nitrate of Soda	----	----	----	----	----	----	1499 7	135.6
COAHOMA COUNTY								
	John McAlister, Lula Loam Soil				**W. T. Allen, Lyon Loam Soil**			
	1923		1924		1923			
0—Check	642.6	----	960.9	----	88.5	----		
100 Lbs. Nitrate of Soda	867 0	224.4	1256.9	296.0	123.0	34.5		
150 Lbs. Nitrate of Soda	969.0	326.4	1159.6	198.7	129.0	40.5		
150 Lbs Nitrate of Soda and 150 Lbs. Acid Phosphate	894.0	251.4	1233.9	273.0	153.0	64.5		
200 Lbs. Nitrate of Soda	933.6	291.0	1317.0	356.1	183.0	94.5		
250 Lbs. Nitrate of Soda	873.6	231.0	1131.5	170 6	228 0	139.5		
300 Lbs. Nitrate of Soda	----	----	1244.4	283.5	----	----		
	J. J. Myers Mattson Loam Soil		**Mrs. Wm. H. Stoval Stovall Loam Soil**					
	1923		1924		1925			
0—Check	403.2	----	722 5	----	1348.5	----		
100 Lbs. Nitrate of Soda	572.4	169.2	853 0	130.5	----	----		
150 Lbs. Nitrate of Soda	576.0	172.8	935.2	212.7	1653.7	305.2		
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	654 0	250.8	997 9	275.4	----	----		
200 Lbs. Nitrate of Soda	606 0	202.8	1148 3	425.8	1635.4	286.9		
250 Lbs Nitrate of Soda	780.0	376.8	1079.1	356.6	1745 7	397.2		
300 Lbs. Nitrate of Soda	----	----	1100 4	377.9	1725.1	376.6		

Coahoma County: C. G. Steele, County Agent, has cooperated with the farmers indicated in conducting the four tests for which the latter part of table 5 gives data. The increases from acid phosphate in these tests have been too inconsistent for conclusions. Nitrogen has paid very consistently in Coahoma County.

Other Counties: The tests for which table 6 gives data were all conducted in the Delta except those at Charleston. These two tests were not included in the averages given in table 7. W. R. Lominick, B. R. Brady, J. R. O'Neil, and J. W. Whitaker, County Agents, cooperated with the planters indicated in conducting these tests.

All Tests: Table 7 summarizes the 37 tests conducted. Each year the average yields of both buckshot and loam soil tests have been made. Contrary to the common belief 150 to 200 pounds of Nitrate of Soda has paid better on buckshot than on loam.

As an average of 25 tests on loam soil 100 pounds of nitrate has increased the yield 150.4 pounds of seed cotton per acre; 150 pounds, 217 pounds; 200 pounds, 279.9 pounds; and 250 pounds of nitrate has increased the yield 319.9 pounds of seed cotton per acre.

TABLE VI—Cooperative Fertilizer Tests in Warren, Quitman, Washington and Tallahatchie Counties.

KIND AND AMOUNT OF FERTILIZER PER ACRE	POUNDS OF SEED COTTON PER ACRE							
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
	Will Biedenharn Redwood Sandy Loam 1923		O. Southall Cedars Silt Loam 1923		J. H. Manning Marks Buckshot Soil 1923		Turner Bros. Marks Loam Soil 1923	
0—Check	612.3	----	351.8	----	576.0	----	657.0	----
100 Lbs. Nitrate of Soda	765.0	152.7	472.8	121.0	720.0	144.0	900.0	243.0
150 Lbs. Nitrate of Soda	870.8	258.5	532.7	180.9	792.0	216.0	1044.0	387.0
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	813.0	200.7	508.2	256.4	792.0	216.0	1080.0	423.0
200 Lbs. Nitrate of Soda	851.9	239.6	620.9	279.1	864.0	288.0	1080.0	423.0
250 Lbs. Nitrate of Soda	981.1	368.8	678.0	326.2	900.0	324.0	1116.0	459.0
300 Lbs. Nitrate of Soda	----	----	----	----	----	----	----	----
	L. C. Hays Hollandale Sandy Loam 1923		Agri. High S. Charleston Hill Land 1924		Agri. High S. Charleston Made Land 1925			
0—Check	716.0	----	466.7	----	920.0	----		
100 Lbs. Nitrate of Soda	862.7	146.7	569.5	102.8	1099.8	179.8		
150 Lbs. Nitrate of Soda	979.9	263.9	697.5	230.8	1296.4	376.4		
150 Lbs. Nitrate of Soda and 150 Lbs. Acid Phosphate	1210.7	494.7	798.6	331.9	1447.2	527.2		
200 Lbs. Nitrate of Soda	1035.9	319.9	677.1	210.4	1233.3	313.3		
250 Lbs. Nitrate of Soda	1158.0	442.0	885.3	418.6	1275.2	455.2		
300 Lbs. Nitrate of Soda	----	----	957.3	490.6	1321.0	401.0		

On buckshot soil the average of 13 tests shows increases as follows; 100 pounds of nitrate 170.3 pounds of seed cotton; 150, 244.7 pounds; 200 pounds, 291.1 pounds; and 250 pounds of nitrate has increased the yield 312.7 pounds of seed cotton per acre.

As an average of all tests on both types of soil the percentage increase was much greater in 1923, a wet year, than in either 1924 or 1925, both of which were dry. The average actual increase in pounds of seed cotton was greater in 1923 when the unfertilized plots averaged only 590 pounds per acre, than in 1924 when these plots averaged 872.5 pounds per acre, or in 1925 when they averaged 1553.5 pounds. Nitrogenous fertilizers have paid consistently both on the Station and on the average well managed Delta plantation each one of the past three years, all of which have been extremes. They will certainly pay any ordinary year on all cotton crops which are well cultivated.

As an average of the 37 tests conducted the first 100 pounds of nitrate has produced cotton worth $7.82 for each 50 pounds applied. The last 50 pounds in the 150 pound application has been worth $7.04. In the 200 pound treatment the last 50 pounds has been worth only $5.51. The last 50 pounds of the 250 pounds produced cotton worth even less—only $4.18. The law of diminishing returns operates from the first but does not enter as a strong factor until 150 pounds per acre is passed.

Conclusions: Sulphate of Ammonia is worth more, pound for pound of Nitrogen contained, than Nitrate of Soda for the first 5 years on Delta Station soils.

Until more is known about it Nitrate of Lime (Calcium Nitrate) should not be purchased unless cheaper, pound for pound of nitrogen, than nitrate of soda and sulphate of ammonia.

Cotton seed meal may be economically used as a source of nitrogen if as cheap as other materials, pound for pound of nitrogen.

150 to 200 pounds of Nitrate of Soda per acre or the same amount of nitrogen in Sulphate of Ammonia will pay on WORKED cotton on average Delta soils.

If it is a question of 150 pounds of nitrate per acre on 100 acres or 100 pounds per acre on 150 acres use only 100 pounds per acre.

If it is a question of 100 pounds per acre on 100 acres or 50 pounds on 200 acres use only 50 pounds per acre because of diminishing returns as the per acre application increases.

Acid Phosphate should be used on Delta soils made directly from the Mississippi hills. On strictly Delta soils it does not pay nearly so well as the same money invested in nitrogen.

All fertilizers should be applied before cotton is planted for the sake of economy and safety.

TABLE VII—Average of All Delta Fertilizer Tests. 1923-24-25

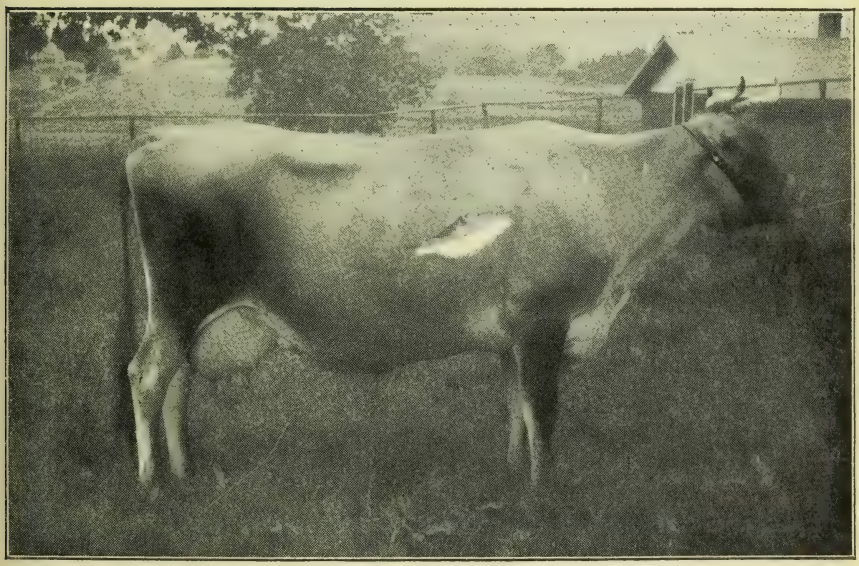
KIND AND AMOUNT OF FERTILIZER PER ACRE	POUNDS OF SEED COTTON PER ACRE							
	1923		1924		1925		AVERAGE	
	Yield	Increase	Yield	Increase	Yield	Increase	Yield	Increase
LOAM SOIL								
	11 TESTS		8 TESTS		6 TESTS		25 TESTS	
None—Check	603.1	------	983.6	------	1632.5	------	971.9	------
100 Lbs. Nitrate of Soda	769.6	166.5	1120 1	136.5	1771.7	139.2	1122.3	150.4
150 Lbs. Nitrate of Soda	849.0	245 9	1200 7	217 1	1796.5	164.0	1188 9	217.0
200 Lbs. Nitrate of Soda	911.1	308 0	1282.5	293 9	1835.3	202.8	1251 8	279.9
250 Lbs. Nitrate of Soda	972.6	369.5	1278.8	295.2	1894.3	261.8	1291.8	319.9
300 Lbs. Nitrate of Soda	------	------	1270.9	287.3	1926.7	294.2	------	------
	8 TESTS		8 TESTS		4 TESTS		20 TESTS	
150 Lbs. Nitrate of Soda	832.4	------	1189.3	------	1412.1	------	1091.1	------
150 Lbs. Nitrate of Soda								
150 Lbs. Acid Phos.	876.4	44.0	1236.8	47.5	1465.9	53.8	1139.5	47.4
BUCKSHOT SOIL								
	7 TESTS		3 TESTS		3 TESTS		13 TESTS	
None—Check	635.3	------	576.1	------	1395.6	------	797.1	------
100 Lbs. Nitrate of Soda	812.9	177.6	801.3	225 2	1493.8	98.2	967.4	170.3
150 Lbs. Nitrate of Soda	871.8	236 5	860.1	284 0	1620.0	224 4	1041.8	244.7
200 Lbs. Nitrate of Soda	913 0	277.7	823.8	247 7	1761.4	365.8	1088.2	291.1
250 Lbs. Nitrate of Soda	1000.1	364.8	850.4	274.3	1625.3	229 7	1109.8	312.7
300 Lbs. Nitrate of Soda	------	------	835.8	259.7	1705.2	309.6	------	------
	5 TESTS		2 TESTS		1 TEST		8 TESTS	
150 Lbs. Nitrate of Soda	73[illegible]	------	845.1	------	2561 7	------	990 2	------
150 Lbs. Nitrate of Soda								
150 Lbs. Acid Phos.	774.2	40.3	799.1	—46.0	2765.9	204.2	1029.4	39.2
AVERAGE OF ALL TESTS—BOTH BUCKSHOT AND LOAM								
	17 TESTS		11 TESTS		9 TESTS		37 TESTS	
None—Check	590.0	------	872.5	------	1553.5	------	908.3	------
100 Lbs. Nitrate of Soda	759.8	169 8	1033 2	160.7	1679.1	125 6	1064.7	156.4
150 Lbs. Nitrate of Soda	833 6	243.6	1107.9	235.4	1737.6	184.1	1135.1	226.8
200 Lbs. Nitrate of Soda	885.4	295.4	1157.4	284.9	1806.0	252 5	1190.2	281 9
250 Lbs. Nitrate of Soda	976.1	386.1	1162 0	289.5	1801.0	247.5	1232.0	323.7
300 Lbs. Nitrate of Soda	------	------	1153.1	280.6	1846.8	293.3	------	------
	13 TESTS		9 TESTS		7 TESTS		29 TESTS	
150 Lbs. Nitrate of Soda	865.4	------	1245.0	------	1501.2	------	1136.7	------
150 Lbs. Nitrate of Soda								
150 Lbs. Acid Phos.	915.8	50.4	1277 0	32.0	1562.6	61.4	1184.0	47.3

Bulletin No. 235 June, 1926

Soybeans for Dairy Cows

By

J. S. Moore and W. C. Cowsert



Gold Medal Champion Jersey Cow of Mississippi, owned by the Mississippi A. & M. College. Record: 13,795 lbs. milk, 714.46 lbs. fat, age 5 years 9 months.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, DIRECTOR

DIGEST

Dairy cows need legume hays for economical production.

Soybeans may be successfully grown in all parts of Mississippi.

Soybean hay ranks high as a protein feed and is also valuable as a source of mineral supply.

The grains of soybeans are rich in protein.

Soybean hay produced 0.6% less milk and 4.89% more butterfat than did alfalfa hay.

Soybean hay produced 4.47% more milk and 4.73% more butterfat than lespedeza hay.

Alfalfa hay produced slightly less milk and fat than did the same amount of lespedeza hay.

Mammoth yellow soybean hay produced 6.67% more milk and 3.62% more butterfat than was produced when the same amount of laredo hay was given.

Well ground soybean hay produced 9.53% more milk and 6.00% more butterfat than an equal amount of unground soybean hay, but the increase was not sufficient to pay the cost of grinding.

Ground soybean seed produced for an average of two test periods 3.64% less milk and 11.65% more butterfat than an equal quantity of cottonseed meal.

Ground soybean seed produced 1.17% more milk and 9.39% more butterfat than did a like quantity of soybean meal.

Soybean meal produced 7.24% less milk and 3.85% less butterfat than was produced by the same amount of cottonseed meal.

SOYBEANS FOR DAIRY COWS

By J. S. Moore and W. C. Cowsert*

The importance of growing sufficient feed of the right quality and using this feed intelligently is or should be of vital concern to every dairyman. In view of the fact that roughage of good quality is often lacking on a dairy farm and that large amounts of money are spent yearly in the purchase of both concentrates and roughage, the Dairy Department has, during the past three years, made experiment for determining the value of some of our common legumes. This bulletin deals primarily with soybeans as a feed for dairy cows. This crop grows well in all parts of the state and it is recognized as a soil builder as well as an excellent hay and grain plant.

RESUME OF WORK DONE BY OTHER STATIONS

McCandlish of the Iowa Station (1) states that soybean oil meal is equal in value to high grade linseed meal when fed as a supplement to dairy cows in a ration of corn silage, alfalfa hay, and a concentrate mixture of cracked corn, ground oats, and wheat bran.

Ground soybeans were compared with cottonseed meal by Price of the Tennessee Station (2). Using these feeds as supplements in a basil ration containing corn silage, alfalfa hay and corn and cob meal, he found that the ration containing the soybean meal gave an increase over the cottonseed meal ration of .8 pounds milk and .04 pounds fat.

The Massachusetts (3) and New Jersey (4) Experiment Stations found ground soybeans slightly superior to cottonseed meal for butterfat production.

Gilchrist of England (5) showed the soybean cake to be slightly superior to cottonseed meal for the production of milk.

The result of two trials at the Iowa Station (6) are given by the author as follows: "It would appear from the results that cracked soybeans give somewhat greater returns in the form of butterfat than does oil meal when fed to cows as a protein supplement to a home-grown ration of corn silage, alfalfa hay and corn and oats."

The South Dakota Station (7) conducted two trials using ground soybeans and old process linseed oil meal as protein supplements to alfalfa hay, corn silage, and a grain mixture of corn and oats. The conclusions are that ground soybeans proved to be 20% more valuable for milk production and 18% more valuable for fat production than the oil meal. Tests were also made to determine the effect of ground soybeans on the butter and the conclusions of the authors are that at

*This bulletin includes work done by a former Station Dairy Experimentalist, Earl Brintnall. Acknowledgment is also made of the co-operation of the State Chemist, Dr. W. F. Hand, in making analyses of the feeds used.

least 50% by weight of the grain ration must be made up of soybeans before any appreciable softness in the butter can be detected, and that this feed does not affect the flavor or odor of the butter.

The West Virginia Station (8) conducted two trials comparing soybean hay with alfalfa hay for milk production. In these tests a basil ration consisting of 30 pounds of silage to each 1,000 pounds live-weight and a grain mixture at the rate of one pound for each three and one-half pounds of milk produced, was fed. In addition, 10 pounds of alfalfa or soybean hay per day were fed to each animal. The combined results of the two experiments as given by the authors of the bulletin are as follows:

1. Twenty cows fed on soybean hay along with a basil ration for 21 days produced 64.6 pounds of milk and 5.42 pounds of butterfat more than did the same 20 cows fed for a like period on alfalfa hay and the same basil ration.
2. The cows fed soybean hay and the basil ration gained a total of 150 pounds in live-weight during the 21-day period, while the same 20 cows fed alfalfa hay and the basil ration lost a total of 22 pounds in live-weight.
3. Feeding trials herein described indicate that good soybean hay is superior to alfalfa hay as a feed for milk and butterfat production and for maintenance of body weight of milk cows.

References:

1. Journal of Dairy Science 5-1922, pages 27 to 38.
2. Price, J. N.—Tennessee Bulletin No. 80.
3. Massachusetts (Hatch) Report 1894.
4. New Jersey Report 1913—E. S. R. Volume 32, Page 573.
5. Mark Land Express 100-1909, Page 667.
6. Iowa Station—Bulletin 204.
7. South Dakota Station—Bulletin No. 215.
8. West Virginia Station—Bulletin 181.

SOYBEANS FOR DAIRY COWS

Plan of Experiments:—In carrying out the work as outlined in the following tests, care was exercised in selecting the cows that were to be used, giving due attention to ability for milk production, per cent of fat in milk, weight of cows, and length of lactation period. Groups of five cows each were selected. In most of the tests reported it will be noted that the reversal method was followed. In all of the tests made, the cows were weighed for three consecutive days at the beginning and at the close of the trials, the average of the three weighings being taken as the true weight. The milk of each milking period was weighed and a ten days' composite sample was taken to ascertain the per cent of fat in the milk. All of the feed was weighed and also the refuse to determine the amount eaten. The feeds used in the various tests were analyzed by the State Chemist and his analyses are given in Table 1.

One group of cows used in tests to determine feeding values of soybean hays

Table 1. Analysis of feeds used in experiments

Feeds	Year	Water	Dry Matter	Protein	N.F.E.	Fat	Ash	Fibre
Alfalfa hay	1923	7.67	92.32	21.56	40.15	4.06	8.13	18.41
Mammoth Yellow Soybean hay	1923	20.70	79.30	10.91	33.03	1.62	7.08	26.66
Laredo Soybean hay	1925	7.35	92.65	8.88	35.71	2.58	4.50	40.98
Lespedeza hay	1923	7.00	93.00	9.75	40.92	1.97	4.28	36.08
Mammoth Yellow Soybeans, ground	1924	6.06	93.94	39.06	24.84	19.26	4.90	5.88
Biloxi Soybean meal	1923	10.00	90.00	42.00	16.32	17.51	4.92	9.25
Soybean meal	1924	7.60	92.40	50.38	27.59	6.35	3.90	4.18
Cottonseed meal	1923	7.00	93.00	41.06	28.89	6.96	6.40	9.69
Cottonseed meal	1924	7.63	92.37	42.19	28.31	7.89	6.52	7.46
Cottonseed meal	1925	6.80	93.20	46.13	24.30	8.77	6.60	7.40
Wheat bran	1925	9.15	90.85	16.00	54.85	2.85	6.70	10.45
Corn chops	1925	9.00	91.00	8.63	74.50	3.42	1.60	2.85
Hominy feed	1925	8.65	91.35	10.19	67.79	5.97	2.35	5.05
Corn silage	1925	77.24	22.76	2.00	11.96	0.55	1.64	6.61

Soybean Hay vs. Alfalfa Hay:—Alfalfa is recognized as one of the best hays for milk production. It is a crop that is adapted to the soils in many sections of the United States. It has a high protein and mineral content and in addition, is palatable. This crop can be grown successfully in a part of Mississippi, but over a considerable area the land is not adapted to its growth. This test was made to determine the relative feeding value of soybean hay as compared with this, more or less, standard hay. There were five cows in the lot and they were fed for three 30-day periods, the first ten days of each period being allowed for changing feeds, and the last 20 days only of the period being

used in the experiment proper. Alfalfa was fed during the first and third periods and soybean hay was fed the second period. The basil grain ration consisted of 50% corn chops, 25% wheat bran, and 25% cottonseed meal by weight. In addition to the hay and grain, the cows received corn silage.

Table 2. Data concerning cows and feed consumed during test—*Nov. 6, 1922

No. of cow	**Breed	Age	Date of: Freshening	Date of: Breeding	Live-wt. at Start	Period 2 Soybean: Hay	Period 2 Soybean: Silage	Period 2 Soybean: Grain	Periods 1 and 3 Alfalfa: Hay	Periods 1 and 3 Alfalfa: Silage	Periods 1 and 3 Alfalfa: Grain
1	J.	7	6-27-22	12- 8-22	961	240	500	100	240	500	100
2	J.	7	9-26-22	1-16-23	685	200	400	120	200	400	120
3	J.	5	11- 1-22	1- 9-23	797	200	400	130	200	400	130
4	A.	4	8-27-22	11-18-22	904	240	500	80	240	500	80
5	A.	11	10-14-22	3- 6-23	754	200	400	80	200	400	80
Totals						1080	2200	510	1080	2200	510

*Date on which the test was started.

**In this and succeeding tables, "J" stands for Jerseys and "A" for Ayshires.

Table 3. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Soybean: Milk, lbs.	Period 2—Soybean: Fat %	Period 2—Soybean: Fat, lbs.	Gain or loss in live-wgt.	Periods 1 and 3—Alfalfa: Milk, lbs.	Periods 1 and 3—Alfalfa: Fat %	Periods 1 and 3—Alfalfa: Fat, lbs.	Gain or loss in live-wgt.
1	202.5	5.04	10.20	-15	204.0	4.65	9.48	5.0
2	352.9	4.90	17.31	-26	368.7	4.37	15.91	10.0
3	466.5	4.20	19.59	-21	472.7	3.96	18.73	0.5
4	376.0	3.15	11.84	-23	355.7	2.97	10.57	13.5
5	341.9	3.00	10.26	-15	359.9	2.87	10.33	6.0
Totals	2739.7	3.98	69.20	-100	2756.0	3.70	65.02	35.0

Table 4. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. milk: Hay	Feed per 100 lbs. milk: Silage	Feed per 100 lbs. milk: Grain	Feed per 1 lb. fat: Hay	Feed per 1 lb. fat: Silage	Feed per 1 lb. fat: Grain
Alfalfa ration 1 and 3	2756.0	65.02	39.18	79.82	18.50	16.61	33.88	7.84
Soybean ration 2	2739.7	69.20	39.42	80.31	18.61	15.61	31.79	7.37
Difference	-16.3	3.18	.24	.49	.11	-1.00	-2.04	-.47

While the cows were on the alfalfa hay ration, they ate 88.24% of the alfalfa given. When on the soybean hay ration, they ate 83.15% of the soybean hay. The yield of milk in the alfalfa periods was 16.3 pounds more and the yield of fat was 4.18 pounds less than during the soybean period. The cows lost a total of 100 pounds live-weight on the soybean, but gained 35 pounds on the alfalfa. It required slightly more feed on the soybean ration to produce 100 pounds of milk, but less feed to produce 1 pound of fat than on the alfalfa ration.

Soybean Hay vs. Lespedeza Hay:—Lespedeza grows well in all parts of Mississippi. It is one of the best pasture crops and will make some growth on the very poor and badly washed soils. It is an excellent crop for soil improvement. On good land the yield of hay is satisfactory.

ranging from one to three tons per acre. This is one of the easiest of all legumes to save. Its nutritive value is high and it is palatable. In making this test, five cows were used. The periods were the same as for the test with alfalfa—the first ten days of each period being used as a transmission period and the last twenty days for the test proper. The grain in this test consisted of a mixture containing 300 pounds cottonseed meal, 200 pounds wheat bran, 100 pounds hominy feed, 100 pounds rice bran, and 100 pounds rice polish. In addition and included in the grain ration, each cow received three pounds per day of blackstrap molasses.

Table 5. Data concerning cows and feed consumed during test, Dec. 22, 1924

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Lespedeza			Periods 1 and 3 Soybeans		
			Fresh-ening	Breed-ing		Hay	Silage	Grain	Hay	Silage	Grain
6	A.	7	7-30-24	12-30-24	1026	300	400	200	300	400	200
7	A.	10	9-26-24	11-13-24	849	300	400	260	300	400	260
8	J.	8	8-29-24	10-28-24	778	240	400	200	240	400	200
9	J.	8	8-16-24	11-21-24	783	240	400	260	240	400	260
10	J.	8	11-23-24	1- 6-25	787	200	400	260	200	400	260
Totals						1280	2000	1180	1280	2000	1180

Table 6. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Lespedeza			Gain or loss in live-wgt.	Periods 1 and 3 Soybeans			Gain or loss in live-wgt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
6	443.1	3.40	15.07	38	436.2	3.51	15.30	-74
7	511.4	3.10	15.85	-2	597.1	3.10	18.48	-18
8	316.3	4.85	15.34	-30	330.6	4.75	15.70	-2
9	519.9	4.35	22.62	-4	515.4	4.23	21.82	-36
10	644.4	4.12	26.55	-4	664.8	4.31	28.64	-52
Totals	2435.1	3.92	95.43	58	2544.1	3.93	99.94	-146

Table 7. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. milk			Feed per 1 lb. fat		
			Hay	Silage	Grain	Hay	Silage	Grain
Lespedeza ration, 2	3435.1	95.43	52.56	82.13	48.46	13.31	20.95	12.36
Soybean ration, 1 and 3	2544.1	99.94	50.31	78.61	46.38	12.81	20.01	11.81
Difference	109.0	4.51	-2.25	-3.52	-2.08	-.60	-.94	-.55

On soybean hay the cows gave 109 pounds more milk and 4.51 pounds more fat than when on the lespedeza hay, but lost 146 pounds live-weight, while they gained 58 pounds when fed the lespedeza hay. In this connection, however, it will be noted that three of the five cows lost in weight while getting lespedeza hay and one cow gained in weight on the soybean hay. The hay refuse during the soybean period was 18.84% greater than when the cows were fed lespedeza hay.

The cows in this test not only produced more milk and fat when fed the soybean ration, but they required less feed per 100 pounds of milk and 1 pound of fat than when fed on the lespedeza ration.

Lespedeza vs. Alfalfa Hay:—Another test was also made to compare the feeding value of lespedeza and alfalfa hays, using the same number of cows, periods, and basil rations as in Table 2.

Table 8. Data concerning cows and feed consumed during test—Nov. 6, 1922

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Lespedeza			Periods 1 and 3 Alfalfa		
			Fresh-ening	Breed-ing		Hay	Silage	Grain	Hay	Silage	Grain
11	J.	6	6-17-22	11-29-22	722	160	500	100	180	500	100
12	J.	7	8-15-22	1- 8-23	720	160	400	115	180	450	115
13	J.	9	10- 4-22	12-21-22	942	160	500	90	180	500	90
14	A.	4	10-26-22	12- 3-22	995	156	470	131	200	500	140
15	A.	6	9- 6-22	11-28-22	921	160	500	120	200	500	120
Totals						796	2370	556	940	2450	565

Table 9. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Lespedeza			Gain or Loss in Live-wgt.	Periods 1 and 3—Alfalfa			Gain or Loss in Live-wgt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
11	314.7	4.35	13.69	-20	345.5	4.13	14.26	2
12	341.0	4.30	14.66	-7	387.9	4.25	16.50	-3
13	284.8	4.20	11.96	-27	301.5	3.87	11.67	-14
14	503.4	3.60	18.12	-62	601.3	3.60	21.65	-25
15	420.0	3.70	15.53	-3	467.3	3.50	16.36	-1
Totals	1863.9	3.97	73.97	-121	2103.5	3.82	80.45	-41

Table 10. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs	Feed per 100 lbs. milk			Feed per 1 lb. fat		
			Hay	Silage	Grain	Hay	Silage	Grain
Lespedeza ration, 2	1863.9	73.97	42.71	127.15	29.83	10.76	32.04	7.52
Alfalfa ration, 1and 3	2103.5	80.45	44.69	111.72	26.85	11.68	30.45	7.02
Difference	239.6	6.48	1.98	-15.43	-2.98	.92	-1.59	-.50

In the above tables, it will be noted that the cows received during the alfalfa period 144 pounds more hay, 80 pounds more silage and 9 pounds more grain feed than when fed lespedeza. The total loss in live-weight of the cows during the alfalfa period was 41 pounds and during the lespedeza period 121 pounds. When fed alfalfa hay the cows produced a total of 239.6 pounds more milk and 6.48 pounds more fat than when fed lespedeza. Although slightly more hay in the alfalfa ration was fed to produce 100 pounds of milk and 1 pound of fat than in the lespedeza ration, it required less feed as a whole to produce a unit of product when the alfalfa was given.

In all tests reported in the preceding tables, the soybean hay was of the Mammoth Yellow variety. It is recognized that there is a dif-

ference in the yields of the various varieties of soybeans as well as their methods of growth and probably their composition and palatability. An experiment was made to determine the difference, if any, in the feeding values of hays from the mammoth yellow and laredo varieties—two of the most common varieties in the State, and we give below the results of this test.

Mammoth Yellow vs. Laredo Soybean Hay:—Five cows were used for three periods of thirty days each as in the preceding tests. The grain and silage were the same for all periods—the grain mixture being that used for cows reported in Table 5.

Table 11. Data concerning cows and feed consumed during test—Dec. 22, 1924

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Laredo Hay			Periods 1 and 3 Mam. Yel. Hay		
			Fresh-ening	Breed-ing		Hay	Silage	Grain	Hay	Silage	Grain
16	A.	5	9- 2-24	11-17-24	896	300	400	200	300	400	200
17	A.	15	11-22-24	2-18-25	1146	300	400	260	300	400	260
18	J.	7	7-17-24	10-20-24	830	240	400	200	240	400	200
19	J.	6	10-21-24	12- 1-24	891	240	400	260	240	400	260
20	J.	7	9- 4-24	11-28-24	741	200	400	260	200	400	260
Totals						1280	2000	1180	1280	2000	1180

Table 12. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Laredo Hay			Gain or Loss in Live-wgt.	Periods 1 and 3 Mammoth Yellow Hay			Gain or Loss in live-wt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
16	461.5	4.12	19.04	-40	487.6	4.00	19.51	-30
17	635.1	3.42	21.74	-36	698.1	3.35	23.41	-14
18	378.2	4.72	17.87	-4	411.7	4.60	18.94	-28
19	495.2	5.50	27.24	-34	503.0	5.31	26.73	-8
20	380.6	5.37	20.45	30	406.9	5.31	21.60	-44
Totals	2350.6	4.52	106.34	-84	2507.3	4.39	110.19	-124

Table 13. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. milk			Feed per 1 lb. fat		
			Hay	Silage	Grain	Hay	Silage	Grain
Laredo hay ration, 2	2350.6	106.34	54.45	85.08	50.20	12.04	18.80	11.09
Mam. Yel. ration, 1 & 3	2507.3	110.19	51.51	79.76	47.06	11.61	18.15	10.71
Difference	156.7	3.85	-2.94	-5.32	-3.14	-.43	-.65	-.38

The cows receiving mammoth yellow soybean hay produced 156.7 pounds more milk and 3.85 pounds more fat that when fed the laredo hay. On the former, they lost 124 pounds live-weight and on the latter they lost 84 pounds. The mammoth yellow soybean ration required less feed to produce 100 pounds of milk and 1 pound of fat than did the laredo soybean ration.

Ground vs. Unground Soybean Hay:—One of the difficulties encountered in feeding soybean hay in sufficient quantities to reduce the grain feed to a minimum has been our failure to get the cows to eat

enough of the hay to supply their needs. In order to determine whether or not grinding the hay would overcome this difficulty and at the same time be economical, tests were made as given in the tables below. In this test the reversal method was not used. Two lots of five cows each were placed on test. Lot 1 was fed during the first period and Lot 2 was fed during the first and second periods, on unground mammoth yellow soybean hay, while during the second period, Lot 1 received ground soybean hay.

Table 14. Data concerning cows and feeds consumed during test—Feb. 22, 1925

Lot 1 No. of Cow	Breed	Age	Date of: Fresh-ening	Date of: Breed-ing	Live-wt. at Start	Period 1 Soybean Hay: Hay	Period 1 Soybean Hay: Silage	Period 1 Soybean Hay: Grain	Period 2 Ground Soybean Hay: Hay	Period 2 Ground Soybean Hay: Silage	Period 2 Ground Soybean Hay: Grain
16	A.	5	9- 2-24	11-17-24	841	300	400	200	300	400	200
17	A.	15	11-22-24	2-18-25	1103	300	400	260	300	400	260
18	J.	7	7-17-24	10-20-24	812	240	400	200	240	400	200
19	J.	6	10-21-24	12- 1-24	853	240	400	260	240	400	260
20	J.	7	9- 4-24	11-28-24	749	200	400	260	200	400	260
Totals						1280	2000	1180	1280	2000	1180
Lot 2.	**Control lot—Unground soybean hay fed both periods.**										
21	A.	5	8-27-24	11-14-24	892	300	400	200	300	400	200
22	A.	6	10-19-24	12-23-24	855	300	400	260	300	400	260
23	J.	11	8-23-24	10-30-24	812	240	400	200	240	400	200
24	J.	6	9-20-24	11-27-24	831	240	400	260	240	400	260
25	J.	5	11-25-24	12-29-24	719	200	400	260	200	400	260
Totals						1280	2000	1180	1280	2000	1180

Table 15. Production of cows and gain or loss in live-weight

Lot 1 No. of Cow	Period 1—Soybean Hay: Milk, lbs.	Period 1—Soybean Hay: Fat %	Period 1—Soybean Hay: Fat lbs.	Gain or loss in live-wgt.	Period 2 Ground Soybean Hay: Milk, lbs.	Period 2 Ground Soybean Hay: Fat %	Period 2 Ground Soybean Hay: Fat lbs.	Gain or loss in live-wt.
16	468.2	3.93	18.38	-15	479.8	3.70	17.76	29
17	649.6	3.30	21.44	-7	655.1	3.23	21.13	147
18	402.0	4.62	18.59	-14	416.1	4.40	18.31	25
19	475.2	5.45	25.89	-4	504.4	5.15	25.98	40
20	398.4	5.35	21.30	-22	399.1	5.25	20.96	2
Totals	2393.4	4.41	105.60	-62	2454.5	4.24	104.14	243
Lot 2	**Control lot—Unground soybean hay fed both periods**							
21	551.7	3.20	17.65	2	511.7	3.25	16.63	-7
22	713.4	3.33	23.72	-7	663.3	3.05	20.23	-35
23	388.2	4.38	16.98	18	363.5	4.67	16.99	-5
24	430.8	4.65	20.04	-19	400.7	4.60	18.43	4
25	508.8	4.92	25.07	-7	483.9	4.95	23.95	10
Totals	2592.9	3.99	103.46	-13	2423.1	3.97	96.23	-33

It will be noted that where both lots in period 1, received the same feed, the cows in the control lot gave 199.5 pounds more milk and 2.14 pounds less fat than did Lot 1; while in period 2, the lot receiving the ground hay gave 31.4 pounds more milk and 7.91 pounds more fat

than did the lot receiving the unground hay. The most marked difference, however, is in the gain or loss of live-weight during period 2. Lot 1 gained 243 pounds in live-weight and Lot 2 lost 33 pounds. This can probably be accounted for in part, at least, by the fact that in this period the cows in Lot 1 ate 74.06% of the hay and those in Lot 2 ate only 62.97%. These cows received a basil grain mixture throughout both periods consisting of 300 pounds cottonseed meal, 200 pounds wheat bran, 100 pounds each of hominy feed, rice bran, and rice polish; and in the grain ration and considered a part of it were three pounds of blackstrap molasses fed to each cow daily. As a succulent feed, corn silage was used. From the standpoint of difference in the production of milk and butterfat, grinding the hay was not profitable.

In our studies of soybean as a source of feed for dairy cows, we have also made some experiments with the soybean seed as a concentrate. We have compared the ground soybean and the soybean meal with cottonseed meal for feeding dairy cows. The term ground soybeans in this bulletin refers to the whole grain ground and the soybean meal is the product remaining after a portion of the oil has been extracted.

Ground Soybeans vs. Cottonseed Meal:—Two tests have been made in comparing these feeds. In the first test the grain mixture consisted of 50% corn chops, 16 2-3% wheat bran and during the first and third periods 33 1-3% cottonseed meal; while during the second period the cottonseed meal was replaced by 33⅓% ground soybeans, the mammoth yellow variety being used. In addition, corn silage and alfalfa hay were used as roughages.

Table 16. Data concerning cows and feeds consumed during test—Nov. 6, 1922

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Ground Soybean Seed				Periods 1 and 3 Cottonseed Meal			
			Fresh-ening	Breed-ing		Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Test Grain
26	J.	6	5-23-22	10-15-23	741	160	485	80	40	160	500	80	40
27	J.	10	9-14-22		780	160	500	85	45	160	449	90	42½
28	J.	5	9-22-22	11-10-22	828	160	600	110	55	160	600	110	55
29	A.	4	8-20-22	12- 2-22	896	160	500	60	30	160	500	60	30
30	A.	5	10- 2-22	12- 3-22	997	160	642	70⅔	35⅓	160	700	80	40
Totals						800	2727	410⅔	250⅓	800	2749	420	207½

Table 17. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Ground Soybean			Gain or loss in live-wgt.	Periods 1 and 3 Cottonseed Meal			Gain or loss in live-wgt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
26	282.6	5.59	15.81	-18	266.3	5.08	13.53	7.5
27	360.9	5.35	19.32	-41	349.5	5.15	18.00	-24.5
28	509.4	4.61	23.52	-19	524.8	4.24	22.27	-0.5
29	297.4	3.65	10.85	-23	317.5	3.23	10.26	1.0
30	522.1	3.20	16.71	-40	597.9	3.06	18.33	5.0
Totals	1972.4	4.37	86.21	141	2056.0	4.00	82.39	-11.5

Table 18. Feed required for the production of 100 lbs. milk and 1 lb. fat.

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. Milk				Feed per 1 lb. Fat			
			Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Tes Grai
Ground Soybean ration 2	1972.4	86.21	40.56	138.26	20.83	10.39	9.28	31.63	4.76	2.37
Cottonseed ration 1 & 3	2056.0	82.39	38.91	133.70	20.42	10.07	9.71	33.36	5.09	2.51
Difference	83.6	-3.82	-1.65	-4.56	-.41	-.32	-.43	1.73	.33	.14

During periods 1 and 3, when cows were on cottonseed meal, they gave 83.6 pounds more milk and 3.82 pounds less fat than during the ground soybean period. The cows on cottonseed meal lost only a total of 11.5 pounds live-weight, while the cows on ground soybeans lost a total of 141 pounds. The cows required more feed to produce 100 pounds of milk and less feed to produce 1 pound of fat when on the ground soybean ration than was required when fed the cottonseed meal ration. The results of the second test are as follows:

Table 19. Data concerning cows and feed consumed during test—Nov. 29, 1923

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Ground Soybean Seed				Periods 1 and 3 Cottonseed Meal			
			Fresh-ening	Breed-ing		Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Tes Grai
31	J.	9	9-18-23	11-25-23	810	200	600	96	48	200	600	96	48
32	J.	10	10- 4-23	2-27-24	906	200	600	80	40	200	600	80	40
33	J.	6	9- 2-23		834	160	600	80	40	160	600	80	40
34	J.	5	6-20-23	2-16-24	766	160	500	80	40	160	500	80	40
35	A.	5	9-30-23	3-24-24	981	200	600	72	36	200	600	72	36
Totals						920	2900	408	204	920	2900	408	204

Table 20. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Ground Soybeans			Gain or loss in Live-wgt.	Periods 1 and 3 Cottonseed Meal			Gain or loss in Live-wgt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
31	451.1	4.30	19.39	-17.0	455.3	4.02	18.30	-16.0
32	373.2	4.07	15.20	-2.0	372.8	3.82	14.24	-5.5
33	335.6	4.77	16.02	5.0	336.6	4.45	14.97	-3.5
34	319.7	5.39	17.24	-25.0	302.6	4.73	14.31	-5.5
35	391.0	3.05	11.92	-5.0	389.7	3.10	12.10	-3.0
Totals	1870.6	4.26	79.77	-44.0	1857.0	3.98	73.92	-33.5

Table 21. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. Milk				Feed per 1 lb. Fat			
			Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Test Grai
Ground Soybean ration 2	1870.6	79.77	49.18	155.03	21.81	10.90	11.53	36.35	5.11	2.56
Cottonseed meal ration 1-3	1857.0	73.92	49.54	156.16	21.97	10.99	12.44	39.23	5.52	2.76
Difference	-13.6	-5.85	.36	1.13	.16	.09	.91	2.88	.41	.20

The grain in this test was the same as in the preceding, the cows in periods 1 and 3 getting cottonseed meal, and in period 2 ground soybeans. For roughage the cows received Johnson grass hay and corn silage. The results of this test show that the cows on cottonseed meal lost 33.5 pounds live-weight and on ground soybeans, 44 pounds. The yields of milk and fat were higher for the soybean period than for the cottonseed meal period, the milk being 13.6 pounds more than the fat, 5.85 pounds more for the former than the latter. The feed required to produce a unit of product was higher when cottonseed meal was fed.

A summary of the two tests shows that the cows getting cotton seed meal gave 70.0 pounds more milk and 9.67 pounds less fat and lost 140 pounds less live-weight than did the cows when fed ground soybeans.

Soybean Meal vs. Cottonseed Meal:—This test was made under the same conditions as the second test made to determine the relative values of ground soybean seed and cottonseed meal. Five cows were used, the same basil rations were given except that soybean meal was used in the grain mixture during period 2 in place of ground soybean seed.

Table 22. Data concerning cows and feed consumed during test—Nov. 29, 1923

No. of Cow	Breed	Age	Date of:		Live-wt. at Start	Period 2 Soybean Meal				Periods 1 & 3 Cottonseed Meal			
			Fresh-ening	Breed-ing		Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Test Grain
36	J.	6	6-10-23	10-18-23	817	160	500	72	36	160	500	72	36
37	J.	7	6- 9-23	11-17-23	742	160	500	80	40	160	500	80	40
38	J.	5	9- 4-23	1-26-24	756	160	500	72	36	160	500	72	36
39	J.	10	10-23-23	2- 6-24	879	200	600	96	48	200	600	96	48
40	A.	6	9-13-23	3-15-24	947	200	600	80	40	200	600	80	40
Totals						880	2700	400	200	880	2700	400	200

Table 23. Production of cows and gain or loss in live-weight

No. of Cow	Period 2—Soybean Meal			Gain or loss in live-wgt.	Periods 1 and 3 Cottonseed Meal			Gain or loss in live-wgt.
	Milk, lbs.	Fat %	Fat, lbs.		Milk, lbs.	Fat %	Fat, lbs.	
36	267.5	4.89	13.09	29.0	270.7	4.87	13.18	7.5
37	346.7	4.07	14.10	15.0	377.8	3.87	14.62	2.5
38	271.0	4.51	12.22	22.0	304.7	4.27	13.01	11.5
39	400.3	4.36	17.46	1.0	429.8	4.16	17.89	-16.0
40	483.7	3.05	14.74	.0	524.2	3.01	15.78	-7.5
Totals	1769.2	4.05	71.61	67.0	1907.2	3.90	74.48	-2.0

Table 24. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. milk				Feed per 1 lb. Fat			
			Hay	Silage	Mixed Grain	Test Grain	Hay	Silage	Mixed Grain	Test Grain
Soybean meal ration 2	1769.2	71.61	49.74	152.61	22.61	11.30	12.28	37.70	5.58	2.79
Cottonseed meal ration 1 and 3	1907.2	74.48	46.14	141.53	20.97	10.48	11.81	36.25	5.37	2.68
Difference	138.0	2.87	-3.60	-11.08	-1.64	-.82	-.45	-1.45	-.21	-.11

The cows during the cottonseed meal period lost a total of 2 pounds in live-weight, while the cows in the soybean meal period gained 67 pounds. When fed cottonseed meal, the cows gave 138 pounds more milk and 2.87 pounds more fat than they gave during the soybean meal period. The cows required less food to produce both a unit of milk and a unit of fat when given the cottonseed meal ration.

Ground Soybeans vs. Soybean Meal:—In addition to the above test, a check was made by comparing the relative values of ground soybeans vs. soybean meal. Five cows were started in this test, but one of these was taken sick while the test was in progress and had to be eliminated. Johnson grass hay and corn silage were used for roughage as in the preceding tests, and the grain mixture consisted of 50% corn chops, 16⅔% wheat bran and in periods 1 and 3, 33⅓% soybean meal and in period 2, 33 1-3% ground soybeans.

Table 25. Data concerning cows and feed consumed during test—Nov. 29, 1923

No. of Cow	Breed	Age	Date of: Freshening	Date of: Breeding	Live-wght. at start	Period 2 Ground Soybeans: Hay	Silage	Mixed Grain	Test Grain	Period 1 and 3 Soybean Meal: Hay	Silage	Mixed Grain	Test Grain
41	J.	8	9-15-23	3- 8-24	707	160	500	80	40	160	500	80	40
42	J.	6	10-25-23	1-16-24	738	200	600	136	68	200	600	136	68
43	J.	6	8-29-23	11-17-23	805	200	600	72	36	200	600	72	36
44	A.	5	9-17-23	10-27-23	957	200	600	80	40	200	600	80	40
Totals						760	2300	368	184	760	2300	368	184

Table 26. Production of cows and gain or loss in live-weight

No. of Cow	Period—Ground Soybeans: Milk, lbs.	Fat, %	Fat, lbs.	Gain or loss in Live-wt.	Periods 1 and 3—Soybean Meal: Milk, lbs.	Fat, %	Fat, lbs.	Gain or loss in Live-wt.
41	395.0	4.27	16.88	7	393.2	3.97	15.62	-17
42	575.7	4.25	24.54	5	558.3	3.85	21.49	-6
43	277.0	4.77	13.23	11	278.5	4.44	12.36	-20
44	415.6	3.52	14.65	-3	441.1	3.35	13.88	-9
Totals	1663.3	4.17	69.30	-4	1644.1	3.85	63.35	-52

Table 27. Feed required for the production of 100 lbs. milk and 1 lb. fat

Periods	Milk, lbs.	Fat, lbs.	Feed per 100 lbs. milk: Hay	Silage	Mixed Grain	Test Grain	Feed per 1 lb. fat: Hay	Silage	Mixed Grain	Test Grain
Ground Soybean ration 2	1663.3	69.30	45.69	132.28	22.12	11.06	10.96	33.19	5.31	2.65
Soybean meal ration 1 & 3	1644.1	63.35	46.22	139.90	22.38	11.19	12.00	36.30	5.81	2.90
Difference	-19.2	5.95	.53	7.62	.26	.13	1.04	3.11	.50	.25

In comparing these two feeds, we find that the cows receiving the ground soybeans gave 19.2 pounds more milk and 5.95 pounds more fat than they did when fed soybean meal. We also note that less feed

was required to produce 100 pounds of milk and 1 pound of fat when the ground soybeans were fed. When fed ground soybeans, the cows lost only a total of 4 pounds in live-weight, while during the soybean meal period the loss was 52 pounds. In comparing this with the tests given in the preceding tables, there is a slight unaccountable difference in the results obtained concerning the gain or loss in live-weight.

CONCLUSIONS

1. For the production of butterfat, soybean hay is slightly superior to alfalfa hay.

2. Soybean hay is superior to lespedeza hay for both milk and butterfat production.

3. Alfalfa hay is a little better than lespedeza hay for milk and butterfat production.

4. Mammoth yellow soybean hay is superior to laredo hay for milk and butterfat production.

5. Ground soybeans are better than cottonseed meal or soybean meal as a concentrate for the production of butterfat.

6. Soybean meal is a little less valuable than cottonseed meal as a concentrate for milk and butterfat production.

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The Use of First Generation Crosses and Other Methods for Improving Southern Varieties of Corn

By
H. B. BROWN

Effect of Inbreeding Corn. Large Stalk, Goliad open pollinated. Small Stalks, Goliad self pollinated.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director.

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THE USE OF FIRST GENERATION CROSSES AND OTHER METHODS FOR IMPROVING SOUTHERN VARIETIES OF CORN.

By H. B. BROWN

The first step in the improvement of corn was made so long ago that its history is not recorded. Probably it was made by a primitive man who chose from among the wild corn plants on the plains about him, certain ones that were a little more productive than the average, and thus a little more desirable. The primitive breeder doubtless had no idea of making the crop more productive. He simply saved the best he found. The fact that our cultivated corn is so poorly adapted to survive in competition with the wild plants of nature, may be taken as an indication that it has had the assistance of man since taking on its present form and habits. It has had its present form, in the main at least, for several hundred years. Columbus found the Indians growing corn in America in 1492 and evidence found in caves and ruins indicates that it had been cultivated several hundred years prior to that date.

At the present time corn varieties are being made more productive, and improved in certain ways by four different methods—mass selection, ear-to-row testing, crossing varieties, and by inbreeding following by crossing. Most of these methods have come into use within the last few decades. Mass selection of some form, however, has been practiced for centuries. Each of these methods will be discussed individually and in some detail.

MASS SELECTION

Mass selection is the simplest method of corn breeding, and has proven to be a very satisfactory one. Its use is wide spread. It consists simply in picking out or selecting a large number of good ears from strong, healthy, well developed, productive plants and planting in composite mass, seed from these ears. The breeder, to be most successful, should have in mind clearly the type of plant and ear that he is seeking and select only plants that make a near approach to this ideal type. The same type must be held in mind for a series of years to secure marked results. If selections are made toward a particular form for a number of years a variety of corn may be changed or modified in almost any direction desired. If the variety is mixed or unselected at the beginning, its quality and yielding powers may be improved.

Several of our best known varieties of corn have been produced

by means of mass selection carried on for a period of years. As illustrations, we may mention Leaming, Reids Yellow Dent, Boone County White, and Paymaster. Paymaster was developed by M. H. Neal of Lebanon, Tennessee, from a variety known as Tennessee Red Cob. Mr. Neal has carried on mass selection for about thirty years. During that time he has changed the corn from a one-ear to a prolific variety, made it more uniform and productive, and modified it in various ways.

Mass selection may also be used as a means of maintaining or preserving the good qualities of varieties that have already been improved. They will deteriorate unless some effort is made to keep them up to a high standard.

EAR-TO-ROW METHOD

The ear-to-row method of corn breeding is different from the mass selection method in that the seed of each individual plant selected is kept separate and planted in a row by itself. The choice of the strain to keep, or the final selection, is based on the performance record of the progeny of plants in the row. This appears to be one step better than the mass selection because only the high yielding progenies are saved. A good many of the fine appearing plants that are selected owe their good qualities to some advantage in position in the field, to being first generation hybreds, or to some other special advantage, and are not able to transmit their out-standing qualities to their progenies. Hence, they are not desirable.

In the past some good results have been secured by means of the ear-to-row method. Some varieties which are uniform, good yielders, and well adapted to particular regions, have been isolated and developed by this method and are real additions to the agriculture of the country. More recently, however, the results secured have not been so satisfactory. It appears that with many of our best varieties the limit of improvement by means of this method has been reached. Certain of the progenies when grown appear to be better than the average and may out yield the original strain by twenty per cent, or even more, but when they are increased in multiplying fields and later tested in comparison with the original strain they appear to be little if any better. It is now generally believed by investigators that the method may be of value in isolating desirable strains from mixed varieties but cannot be used in making further gains with well adapted standard varieties.

In Pennsylvania, Noll (1) found that ear-to-row breeding of one variety, followed by crossing strains from the remnants of the best yielding ears, did not materially increase the yield.

Recently Smith and Brunson (2) of the Illinois Experiment Station published results from an ear-to-row breeding experiment that had been in progress for ten years. They used an unnamed variety of no particular breeding but adapted to the region. High yield and low yield breeding plats were maintained throughout the period. Con-

tinued selection for high yields and for low yields resulted in a marked difference in the two strains in respect to yield but the high yielding selections surpassed very little the original strain which was carefully mass selected each year. As a result of their tests the writers conclude:

"1. Continuous selection by means of the ear-to-row breeding plot cannot be recommended as a means of increasing the yield of a well adapted variety of corn.

"2. By continuous mass selection the yield of a well adapted variety of corn can be maintained and perhaps somewhat increased."

Williams and Welton (3) of the Ohio Experiment Station are among the few recent experimenters who have obtained satisfactory results from the use of the ear-to-row method of corn breeding. They report that eighteen out of twenty strains developed in their breeding plots produced more than the parent strain, exceeding it by a margin of one and one-half to eleven bushels per acre.

Kisselbach (4), of the Nebraska Experiment Station, in a five year test of ear-to-row strains found that: "1. Continuous ear-to-row breeding resulted in eight tenths per cent lower yield than the original; (2) increasing the eight best strains in composite under isolation yielded four and seven tenths per cent less than the original; and (3) crossing of ear-row strains yielded one and seven tenths per cent more than the original corn." The author says further: "Improvement in yield of an adapted variety through ear-to-row breeding seems rather uncertain, and two and six tenths per cent increase is the maximum attained in these experiments. In the initial ear-to-row tests, the strains which were continued in these experiments yielded approximately twenty per cent more than the original corn."

Hume (5) of the South Dakota Experiment Station, and Hays and Alexander (6) of the Minnesota Experiment Station in their experiments with ear-to-row breeding secured but very little positive evidence of gains in yield.

At the Mississippi Experiment Station at A. & M. College ear-to-row breeding work was begun in 1910 and continued ten years. Mosby, a prolific variety which had been grown on the College farm for many years and which appeared to be well adapted to the region was used as foundation stock. A number of strains appeared among the progenies from time to time, that yielded well above the average, and above the yield of the original variety. Some of these promising strains were increased in isolated patches from the ear remnants held in reserve, thus keeping the strains pure. When these strains were later tested in comparison with the parent strain they were usually found to be inferior in yield, due no doubt to the harmful effects of the inbreeding in the isolated patch. Later mixing seed from remnant ears of some of the best yielding strains was tried but this gave no decided gains. Next we tried planting seed from the remnants of the ears that gave the best yielding progenies in a breeding patch where alternate rows were de-

tasselled. This gave a slight increase in yield over that of the parent strain in about sixty per cent of the trials but in no case was the gain more than 4.6 per cent.

The ten years work using different modifications of the ear-to-row method of corn breeding gave no significant gains. In the light of this experience the method cannot be recommended to farmers for practical use if they have a fairly uniform well adapted variety already.

FIRST GENERATION CROSSES OF VARIETIES.

It has been known by plant and animal breeders for a good many years that crossing closely related species, varieties, or breeds will usually give rise to offspring of increased vigor and size.

In 1876, Beal (7) of Michigan showed by experiments that first generation hybrids between varieties of corn might out yield either of the parents.

Morrow and Gardner (8) of Illinois in 1893 tested nine first generation hybrids in comparison with parent varieties which were adapted to the region. Five of the crosses out yielded their better yielding parent.

Collins (9) of the United States Department of Agriculture tested at Lanham, Maryland, sixteen crosses of widely different types of corn. Twelve of the first generation hybrids outyielded the better yielding parent.

Hays (10) reports a test in Connecticut in which twenty-seven first generation crosses are compared with their parents which were adapted varieties. Fifteen of the crosses outyielded their better yielding parent.

Hartley and others (11) of the Office of Corn Investigations, U. S. Department of Agriculture, carried on crossing experiments with corn for about ten years. All types obtainable were crossed. They report: "Of the first generation crosses tested some were unusually productive, some good, some indifferent, and some unusually poor producers." In 1910 tests were conducted in Maryland, Georgia, Texas, and California. In the two tests in Maryland but two crosses uniformly produced more than their best parent. Five crosses produced less. In California, nine crosses outyielded either parent and nine did not. The gain in yields was from 4 to 20 per cent. Several of the crosses that produced best in California were different from the best producers in Maryland. At Waco, Texas, in ten of the twelve comparisons, crosses outyielded the better parent, the increase ranging from 3 to 29 per cent. At Sherman, Texas, crosses outyielded the better parent in but four of fifteen comparisons. At Corsicana, Texas, the crosses outyielded the better yielding parent in eight out of fourteen crosses. In Georgia in 1910, eight of the twenty crosses gave better yields than the higher yielding parent. It is evident from the work of Hartley and

associates that the value of the cross depends, in a measure at least, on the adaptation of the parent varieties to the locality grown and to the prevailing weather of the season. Certain crosses ranked better some years than they did others, and they ranked better in some localities than in others. The authors conclude: "Present knowledge indicates that the economic increase of corn yields by means of crossing is attended with many complexities."

Jones and others (12) report results of tests made at two stations in Connecticut. Adapted varieties were used. In eighteen cases out of twenty-seven, the first generation crosses exceeded their better yielding parent in yield.

Hays and Olson (13) carried on crossing experiments in Minnesota from 1915 to 1918 inclusive. Crosses were made between flint and dent varieties, and also between different varieties of dent corn. Standard varieties were used. Eleven first generation crosses exceeded their better yielding parent from 0.3 to 32.5 per cent, while one yielded 2.7 per cent less than the better parent. In general the crosses were intermediate between their parents in maturity, height of plant, length of ear, shelling per cent and number of rows per ear, but as a rule, the average of the hybrids exceeded the average of the parents. In most cases greater increases in yields were obtained from crosses between dent and flint or dent and flour varieties.

Griffee (14) in a summary of results from corn crossing experiments made at various places prior to 1922 shows that according to the data on one hundred and forty-six first generation crosses, one hundred and thirteen exceeded the parental average in yield of grain and eighty-four exceed the better yielding parent. The average increase over the parental average is 11.7 per cent.

First Generation Crosses in Mississippi*

In 1913 an experiment was started by the Mississippi Experiment Station at A. & M. College, Mississippi, to determine the economic value of first generation hybrids between various types of corn grown in the Southeastern States.

Seed of the varieties used was obtained from the originators of the varieties or from responsible sources and propagated in isolated patches from year to year as long as the variety was used. The College owned two thousand acres of land. The part cultivated by the Experiment Station extended along a narrow valley for a distance of approixmately three miles and the hills on either side of the valley were in pasture. This gave exceptional opportunities for propagating several varieties without getting them mixed. The soil used throughout the experiment was loamy valley soil of moderate fertility. Good culture was given each year and yields ranged from about thirty to about fifty

*This experiment was planned by E. C. Ewing and conducted by him in 1913 and 1914. J. F. O'Kelly assisted with the work in 1920 and 1921.

bushels per acre.

The varieties were crossed by planting them in rows alternating with some one variety which was used as male or pollen parent. All the rows except those of the pollen parent were detasselled by hand.

The production of the crosses was determined by planting them in rows between rows of the parent strains, six to eight replications being used in each test. Most of the varieties used were standard varieties and were acclimated to some extent before the experiment was ended.

Varieties Crossed.

Below is a brief characterization of the varieties used in the experiments. Further data are given in the tables that follow.

Alabama Yellow. This variety had been used in breeding work at the Alabama Station for a number of years and was fairly uniform. It was only fair as a producer, medium among southern varieties in respect to earliness, and had plants of medium size. The ears were rather small, slender, smooth, and kernels were flinty, short, rounded, and golden yellow.

Boone County White. This variety came originally from the Corn Belt in the North but was grown in Mississippi until somewhat acclimated. In the North it is one of the late varieties but in the Mississippi experiments, it was one of the earliest. The plants were moderately small and each bore normally one large, cylinderical ear with deep, rough grains.

Cocke's Prolific. The strain used was from a selection made by J. B. Allen of Port Gibson, Mississippi. It had been grown in Mississippi for some years and was well acclimated and well adapted, being one of the best producers grown. The stalks were large, tall and vigorous in growth; each bore, normally, two rather long, slender, smooth ears with medium short, medium rounded, semi-flinty grains. The variety was medium in respect to earliness and uniformity.

E-1. This variety was imported from South Carolina. The plants were of medium size and vigor and had an ear similar to the Mosby type but was slightly thicker and had a red cob.

Florida Flint. This is a southern variety. The seed used was obtained from the Hastings Seed Co., of Atlanta, Ga. The plants were early, only moderately uniform, and were small for a southern corn. About thirty per cent of the stalks bore two ears. The ears were medium short and medium thick with medium length kernels which had a tendency toward smoothness and a white cap. This is not a true flint corn, the kernels being scarcely at all flinty.

Gourd Seed. This variety had large ears, and was predominantly a one-ear variety. Seed came from Texas.

Goliad. This variety had been grown on the College farm for several years before it was used in the crossing experiments. It was late

in maturity, moderately uniform, and especially adapted to late planting and growing for ensilage. The stalks were very tall and heavy and the ears of medium length and thickness. The kernels were of medium length, smooth, white capped and rather starchy.

Hickory King. The strain used was typical of the variety as grown over the South where it is considered to be well adapted to poor lands. The stalks were rather short but thick, and ears moderately long and slender; kernels were very wide and large but in comparatively few rows.

Hastings. This is a standard, well acclimated southern variety. Seed was obtained from the Hastings Seed Co., of Atlanta, Ga. The plants were fairly uniform and very large and vigorous. This is a very prolific variety; each stalk under good conditions bears two or more ears. The ears are small, short, somewhat tapering, and slightly roughened. The kernels are of medium size and length. This variety is medium in respect to earliness and is a good producer.

Iowa Gold Mine. This was an early northern variety of yellow corn, the seed of which were brought from the North. The plants were small, comparatively, and one eared. The ears were medium size, rough, and rotted badly.

Johnson County White. This variety was brought from Indiana in 1915. The plants became taller and later in maturity after being grown in Mississippi some years. In characteristics this variety resembled Boone County White very closely.

Jones Prolific. This variety was developed by C. E. Jones, of Jackson, Mississippi and is adapted to Mississippi conditions. The plants grown were uniform for a commercial variety. The variety resembles Cocke's Prolific in earliness and in most vegetative and ear characters but the plants are somewhat smaller and ears shorter and more flinty.

Laguna. The variety was imported from Mexico in 1904 by the U. S. Department of Agriculture and has been grown in Mississippi since 1920; it belongs to the Mexican June type, and has large, vigorous plants with heavy foliage. The ears are medium short and rather thick with medium large, smooth, whitecapped kernels.

Mosby. Mosby has been one of the standard corn varieties of the south for many years and is a well adapted variety. The strain used in the tests had been grown on the College farm for several years and propagated by mass selection. It was fairly uniform and produced moderately well. In vegetative characters it resembled Cocke's Prolific but was not quite as vigorous. Plants were medium early, and a high percentage bore two ears. The ears were of medium length and thickness, moderately rough, and had a very small cob.

Munson. This was a large one-ear variety, the seed of which was obtained from Texas.

Paymaster. This variety had been grown and subjected to mass selection in Tennessee for some twenty years before being used in the crossing experiments. The plants when grown in the experiments appeared to be rather early and more than half of them bore two ears. The stalks were rather short and slender. The ears were of medium length and thickness, rather rough, and somewhat tapering. The kernels were of medium width, but rather long. This variety yields well in Mississippi but rots badly and is subject to severe weevil damage.

Rockdale. Seed of this variety was obtained from the Hastings Seed Co., of Atlanta, Ga. The plants were large and vigorous. Each bore, commonly, one large, somewhat tapering ear with rather smooth, rather large kernels.

Shoe Peg. This variety had no known history but was selected on account of its peculiar ear characters. The plants were of medium size and earliness. The ears were short and very thick with long, very slender kernels.

Tennessee Red Cob. This variety name is applied to so many different types of corn that it does not have much significance. However, the strain used in the crossing experiments was of a definite type and was grown on the College farm long enough to become acclimated. The plants were late in maturity, very tall, and had a heavy thick stalk. The ears were rather short, very thick, with very large, smoothe, rather deep kernels. This variety is considered to be well adapted to poor land in North Mississippi.

Vardaman. This variety was developed by W. S. Vardaman of Greenwood, Mississippi and is of hybrid origin. As grown in the experiment it was lacking in uniformity of type but resembled Mosby in earliness and in most vegetative and ear characters.

Welchel. This variety was a one-ear variety which produced exceptionally large ears.

Williamson. This variety was obtained from the Coker Pedigreed Seed Co., of Hartsville, S. C. It was rather uniform and of a distinct type. The plants were of medium size, and earliness, and ears were of medium length, and fairly thick with deep kernels.

Results From Crossing Tests. The data secured in the crossing experiments are given in the following tables. A few words of explanation or comment follows each table.

Table I. Yields of Parent Varieties and Their First Generation Crosses in 1913.

Variety	Plant Yield in Lbs.	Per Cent Gain Over Average of Parents	Per Cent Gain Over Best Yielding Parent
Mosby	245		
Welchel X Mosby	241	8.9	—1.6
Welchel	198		
Mosby	236		
Gourd Seed X Mosby	248	3.9	2.9
Gourd Seed	241		
Mosby	241		
Rockdale X Mosby	257	16.6	6.2
Rockdale	199		
Mosby	239		
Munson X Mosby	259	9.7	7.9
Munson	232		
Mosby	234		
Boone Co. White X Mosby	272	9.9	4.0
Boone Co. White	261		
Mosby	228		
Hastings X Mosby	236	6.8	3.4
Hastings	214		
Mosby	220		
Fla. Flint X Mosby	274	13.5	4.2
Fla. Flint	263		
Mosby	246		
Mosby X Mosby	233	—2.0	—5.6
Mosby	236		
Average of Crosses	252	+8.2	+2.4
Average of Parents	233		

In the 1913 test Mosby was used as the pollen parent. Its average yield was 50.3 bushels per acre [illegible]lorida Flint, the highest yielding parent produced 56.3 bushels. [illegible]one County White was the next highest yielding parent with 55.9 bushels. These two varieties were both early and belonged to the same type. The season evidently was especially favorable to them because they did not rank high in the tests as a rule.

The best yielding hybrid in the test was Florida Flint X Mosby which made a yield of 58.7 bushels. The second best was Boone County White X Mosby, with a yield of 58.3 bushels per acre. The two high yielding parents had the highest yielding hybrids. The average yield of all the crosses was 8.2 per cent better than the average of all the parents, and was 2.4 per cent better than the average of the higher yielding parents in the respective crosses. The best yielding strain in the test, Florida Flint X Mosby, outyielded the best yielding parent, Florida Flint, by 4.2 per cent.

Table II. Yields of Parent Varieties and Their First Crosses in 1914.

Variety	Plat Yield in Lbs.	Per Cent Gain Over Average of Parents	Per Cent Gain Over Best Yielding Parent	Cent Grain
Mosby	138			86
Cocke's Prolific X Mosby	151	—5.0	—16.1	86
Cocke's Prolific	180			82
Mosby	155			86
Hastings X Mosby	163	+6.8	+5.2	86
Hastings	152			85
Mosby	157			86
Vardaman X Mosby	185	+25.8	+17.8	85
Vardaman	137			85
Mosby	150			86
E-1 X Mosby	160	+3.9	+1.3	84.5
E-1	158			84
Mosby	158			86
Munson X Mosby	149	—10.1	—13.4	85
Munson	172			80
Mosby	150			86
Tenn. Red Cob X Mosby	148	—6.3	—11.4	85
Tennessee Red Cob	167			81
Mosby	149			86
Welchel X Mosby	164	+21.9	+10.1	82
Welchel	120			79
Average Crosses	160	+4.6	—1.4	84.8
Average Parents	152.6			84.1

In the 1914 test, Mosby was again used as the pollen parent. The season was less favorable than in 1913 and consequently the yield was lower, being but 30.2 bushels per acre for Mosby. The two highest yielding parents were Cocke's Prolific and Munson with a yield of 36 and 34.4 bushels per acre respectively. The best yielding hybrid was Vardaman X Mosby which yielded 37 bushels per acre. The second best hybrid, Welchel X Mosby, yielded 32.8 bushels. In this test the highest yielding parents did not have the highest yielding crosses. The average yield of all the crosses was 4.6 per cent greater than the average of all the parental averages, but it was 1.4 per cent less than the average of the higher yielding parent. The best hybrid in the test outyielded the best parent by 2.8 per cent.

Table III. Yield of Parent Varieties and First Generation Crosses in 1915.

Variety	Plat Yield in Lbs.	% Gain Over Av. of Parents	% Gain Over Best Yielding Parent	% Grain	Average Height in Feet	Gain in Feet Over Av. of Parents	Leaf Srface in Sq. In.	Gain in Size Over Av. of Parents	No. Stalks
Mosby	161			88.1	10.10		1180		310
Vardaman									
X Mosby	172	+3.3	0	88.5	10.34	+.07	1195	−63	346
Vardaman	172			87.8	10.44		1337		334
Mosby	159			88.1	10.31		1200		310
Mosby X Mosby	162	+0.9	0	86.4	10.15	−.01	1284	+83	322
Mosby	162			88.5	10.10		1203		334
Mosby	162			88.5	10.10		1203		334
Fla. Flint X Mosby	179	+13.3	+10.5	88.5	10.04	+.30	1127	−38	334
Fla. Flint	154			84.1	9.46		1128		336
Mosby	166			88.1	10.08		1202		337
Tennessee Red									
Cob X Mosby	155	−2.5	−6.6	86.6	10.67	+.26	1345	+64	286
Tenn . Red Cob	152			85.9	10.75		1360		261
Mosby	160			88.1	10.13		1158		333
Cocke's Prolific									
X Mosby	173	+8.1	+11.2	86.7	10.14	+.02	1245	+184	341
Cocke's Prolific	151			85.9	10.10		1164		326
Mosby	160			88.1	10.11		1193		312
Munson X Mosby	164	+2.8	+2.5	85.1	10.24	+.24	1234	+50	299
Mosby	159			88.1	9.89		1175		301
Boone County									
White X Mosby	160	+2.6	+0.6	84.7	9.75	+.02	1107	−24	315
Boone Co. White	153			83.0	9.57		1087		306
Average									
Parents	159.3			87.0	10.08		1196		317
Average of									
Crosses	166.4	+4.4	+2.1	86.9	10.19		1219		320

Mosby was again used as the pollen parent in the 1915 experiment. Its yield was 39.5 bushels per acre. The two highest yielding parents were Vardaman, which yielded 42.4 bushels and Mosby with 39.5. The best yielding cross was again Florida Flint X Mosby with a yield of 43.7 bushels, and the next best Cocke's Prolific X Mosby with 42.6 bushels. The Florida Flint and Cocke's Prolific parents ranked comparatively low in yields. The average yield of the crosses was 4.4 per cent higher than the average of all the parents and was 2.1 per cent better than the average of the best parent in the respective crosses. The leading hybrid in the test outyielded the best parent by 3.1 per cent. From a study of the table it may be seen also that the average of the crosses exceeded the parental average in respect to height of plant, amount of leaf surface, but was slightly less in per cent of grain.

Table IV. First Generation Crosses of Strains with Which Close Breeding Had Been Practiced.

Variety	Plat Yield in Lbs.	% Gain Over Parent	Number Stalks	Av. Yield Per Stalk
Mosby-52	134		280	.47
Mosby-58 X Mosby 52	161	+20.1	299	.54
Mosby-86	174		289	.60
Mosby-84 X Mosby-86	203	+16.6	322	.63
Mosby-86	180		276	.65
Mosby-97 X Mosby-86	204	+13.3	318	.64

The strains shown in Table IV were originally from ear remnants of high yielding progeny rows. Each ear remnant was planted in a patch by itself where close breeding took place between sister plants. Only a part of the parent strains were available for comparison. It will be observed that the crosses outyielded the parent strains by a rather wide margin.

Table V. Yield of Parent Varieties and First Generation Crosses in 1916.

Variety	Plant yield in Pounds	% Gain Over Average of Parents	% Gain Over Best Yielding Parent	Days from Planting to Tasselling
Mosby-119	109			74
Vardaman X Mosby	121	+13.6	+11.0	74
Vardaman	104			74
Mosby-119	120			74
Boone County White X Mosby	133	−1.1	−10.9	68
Boone County White	147			67
Mosby-119	122			74
Florida Flint X Mosby	141	+17.0	+15.6	68
Florida Flint	119			68
Mosby-119	98			74
Tennessee Red Cob X Mosby	93	−3.1	−5.1	74
Tennessee Red Cob	94			75
Mosby-119	116			74
Jones Prolific X Mosby	149	+18.3	+9.5	69
Jones' Prolific	136			69
Mosby-119	103			74
Williamson X Mosby	106	+12.2	+2.9	74
Williamson	86			74
Mosby-119	105			74
Mosby X Mosby	112	+8.7	+6.6	74
Mosby-119	101			74
Mosby-119	101			74
Cocke's Prolific X Mosby	109	+3.3	−0.9	72
Cocke's Prolific	110			74
Average of Parents	110.7			72.9
Average of Crosses	120.2	+8.6	+3.3	71.6

Mosby-119 was used as the male parent in the 1916 experiment. This was a pedigreed strain of Mosby. It was more uniform in vegetative characters than the parent strain but probably no better yielder,

the yield being 23.4 bushels per acre. The crosses outyielded the parental average by 8.6 per cent and the better yielding parent in the respective crosses by 3.3 per cent. The two leading crosses were Jones X Mosby and Flordia Flint X Mosby, and the best yielding parents Boone County White and Jones Prolific. The best cross in the test out yielded the best yielding parent by 1.3 per cent. The crosses averaged 1.3 days earlier than their parents.

Table VI. Yields of Parent Varieties and Their First Germination Crosses in 1917.

Variety	Plat Yield in Pounds	% Gain Over Average of Parent	% Gain Over Best Yielding Parent
Vardaman	202		
Vardaman X Vardaman	184	−5.6	−8.9
Vardaman	192		
Vardaman	192		
Mosby X Vardaman	181	−0.5	−5.7
Mosby	172		
Vardaman	181		
Cocke X Vardaman	185	−3.1	−7.9
Cocke	201		
Vardaman	180		
Jones X Vardaman	192	+7.6	+6.6
Jones' Prolific	177		
Vardaman	182		
Tennnessee Red Cob X Vardaman	146	−6.4	−19.8
Tennessee Red Cob	130		
Vardaman	171		
Williamson X Vardaman	168	+6.6	−1.7
Williamson	144		
Vardaman	129		
Florida Flint X Vardaman	146	+3.9	−3.9
Florida Flint	152		
Vardaman	183		
Boone County White X Vardaman	188	−0.7	−4.1
Boone County White	196		
Vardaman	180		
Johnson County White X Vardaman	195	+18.9	+8.3
Johnson County White	148		
Average of Parents	172.9		
Average of Crosses	176.1	+1.8	−4.3

Vardaman was the pollen parent in 1917. Its average yield was 40.6 bushels per acre. It yielded very well comparatively, but for some reason was not a satisfactory variety to use in crossing. The majority of the crosses yielded less than the average of their parents. The two highest yielding strains in the tests were both parental strains.

Table VII. First Generation Crosses of Strains from High Yielding Progeny Rows Which Had Been Close Bred.

Strain	Plat Yield in pounds	% Gain Over Male Parent
Mosby-4186	142.5	
Mosby-4186 X Mosby-4186	131.0	
Mosby	144.5	
Mosby-4186	136.0	
Mosby-4186 X Mosby-352	156.5	+15.1
Mosby	152.0	
Mosby-4186	128.5	
Mosby-4186 X Mosby-4154	152.0	+10.5
Mosby	150.5	
Mosby-4186	128.5	
Mosby-4186 X Mosby 386	141.0	+9.7
Mosby	145.5	
Average of Crosses	145.1	+8.4
Average Male Parent	133.9	
Average Original Strain	148.2	

In Table VII is shown some data from another experiment in which certain high yielding strains of Mosby which were isolated by means of an ear-to-row test are crossed. Each strain was increased in a separate patch from an ear remnant. In this patch there was close breeding because all the plants came from the same ear. From the table it may be seen that the crosses outyielded the one parent strain with which they were compared. Crossing within the same strain, as in the case of Mosby 4186, gave no gain. Apparently the crossing was not sufficient to overcome the harmful effect of the close breeding because the crosses did not, on the average. yield as well as the original strain, Mosby.

Table VIII. Yields of Parent Varieties and Their First Generation Crosses in 1918.

Variety	Plat Yield in Lbs.	% Gain Over Av. of Parents	% Gain Over Best Yielding Parent	% Of Grain	Days From Planting to Tasseling
Jones' Prolilif	207			84.7	90
Jones' Prolific X					
Jones' Prolific	200	−3.4	−3.4	83.3	90
Cocke's Prolific	224			83.3	90
Cocke's Prolific X					
Jones' Prolific	212	−1.1	−5.3	86.6	
Mosby	222				92
Mosby X Jones Prolific	225	+4.4	+1.4	86.2	94
Vardaman	240			84.5	92
Vardaman X					
Jones' Prolific	246	+10.1	+2.5	85.0	92
Alabama Yellow	201			82.2	91
Alabama yellow					
X Jones' Prolific	241	+18.1	+14.4	82.8	91
Boone County White	199			83.6	88
Boone County White					
X Jones Prolific	215	+5.9	+3.8	83.3	88
Florida Flint	197			84.8	90
Florida Flint X					
Jones' Prolific	209	+3.5	+0.9	84.2	90
Tenn. Red Cob	229				92
Tenn. Red Cob X					
Jones' Prolific	238	+9.1	+3.9		93
Average of Crosses	223.2	+5.8	+2.5	84.2	91.1
Average of Parents	210.1			83.8	90.6

In Table VIII is given data from the 1918 test. Jones' Prolific was used as the male plant, its yield per acre being 41.4 bushels. The crosses again outyielded the parent varieties, the average increase being 5.8 per cent. The best yielder in the test was a hybrid, Vardaman X Jones' Prolific, which yielded 49.2 bushels per acre. This was 2.5 per cent more than the best parent yielded. The second best yielder was also a hybrid, Alabama Yellow X Jones' Prolific, while the best yielding parent was Vardaman with 48 bushels per acre. The crosses again had a slightly higher percentage of grain but appeared to be slightly later than their parents.

Table IX. Yields of Parent Varieties and Their First Generation Crosses in 1919.

Variety	Plat Yield in Lbs.	% Gain Over Av. of Parents	% Gain Over Best Yielding Parents	Days from Planting to Tasselling	Yield per Plant in Lbs.	% Barren Stalks	% Two Ear Stalks	Average No. of Stalks
Florida Flint	219.5			81	.465	4.5	8.5	
Florida Flint X Florida Flint	208.0	−5.2	−5.2	81	.434	2.6	3.9	
Johnson Co. White	214.0			80	.395	3.3	4.0	
Johnson Co. White X Fla. Flint	175.0	−19.2	−20.3	83	.335	4.0	2.2	
Jones-Vardaman	225			84	.410	3.2	9.2	
Jones-Vardaman X Florida Flint	190	−14.5	−15.5	87	.359	4.5	10.2	
Jones' Jrolific	199			84	.433	4.9	14.2	
Jones X Fla. Flint	196.0	−6.3	−10.2	83	.344	4.8	8.2	
Cocke's Prolific	233.5			87	.413	7.6	8.0	
Cocke X Fla. Flint	201.5	−11.1	−13.3	86	.379	8.4	7.0	
Hastings	208.0				.393	1.9	6.0	
Hastings X Fla. Flint	200.5	−6.4	−8.6	86	.345	4.5	6.3	
Ala. Yellow	198.5			87	.313	2.1	9.2	
Alabama Yellow X Florida Flint	215.0	+2.9	−2.0	85	.446	2.1	9.2	
Paymaster	222.5			81	.494	0.9	9.4	
Paymaster X Fla. Flint	174.0	−21.2	−21.8	81	.398	4.0	6.2	
Tenn. Red Cob	228.5			82	.430	9.6	3.3	
Tenn. Red Cob X Florida Flint	189.5	−15.4	−17.1	82	.319	5.8	4.4	
Rizer's Red Cob	227.0			83	.409	6.0	0.7	
Rizer's Red Cob X Florida Flint	200.5	−10.2	−11.7	83	.373	3.7	1.8	
Average of Crosses	195.0	−10.4	−12.7	84	.383	4.44	5.98	267.2
Average of Parents	217.5			83	.415	4.40	7.25	267.6

In the 1919 test, Florida Flint was used as the pollen parent. For some reason this variety was unsatisfactory as a parent, all the crosses except one yielded less than the average of their parents, and all yielded less than the better yielding parent in the respective crosses. The majority of the crosses in which Florida Flint was used during previous years were satisfactory and good gains were made. In 1915 the Florida Flint X Mosby cross was the best strain in the test. The Florida Flint variety yielded moderately well, 32.9 bushels per acre, which was better than that of any of the crosses. Cocke's Prolific was the best yielding variety, with 35.0 bushels per acre. A count of the whole number of stalks on the plats showed that there was practically no difference between the crosses and parents if averages were considered. Both had very nearly the same percentage of barren stalks, but the parent strains had considerably better yield per stalk and slightly more two-eared plants.

Table X. Yields of Parent Varieties and Their First Generation Crosses In 1920.

*Variety	Yield Bushel Grain per Acre	% Gain Over Average of Parent	% Gain Over Best Yielding Parent	% Grain	Average No. Stalks
Goliad	38.7			86	241
Goliad X Cocke's Prolific	48.4	+14.8	+5.8	84	238
Cocke's Prolific	46.1			84	245
Tennessee Red Cob	43.8			85	245
Tenn. Red Cob X Cocke's Prolific	47.3	+2.4	−2.7	84	221
Cocke's Prolific	48.6			84	251
Laguna	51.3			85	261
Laguna X Cocke's Prolific	48.0	−5.0	−6.4	86	241
Cocke's Prolific	49.5			84	255
Shoe Peg	38.8			86	247
Shoe Peg X Cocke's Prolific	46.8	+6.1	−5.4	86	253
Iowa Gold Mine	41.1			85	255
Iowa Gold Mine X Cocke's Prolific	43.0	−6.7	−14.1	84	250
Cocke's Prolific	50.1			84	245
Hickory King	36.0			86	239
Hickory King X Cocke's Prolific	50.8	+18.1	+1.4	86	253
Cocke's Prolific	54.4			84	244
Vardaman	38.0			88	232
Vardaman X Cocke's Prolific	49.6	+7.4	−8.8	85	235
Florida Flint	41.4			85	227
Florida Flint X Cocke's Prolific	45.6	+4.3	−0.8	84	243
Cocke's Prolific	46.0			84	234
Average of Crosses	47.5	+7.9	−4.0	86.1	241.9
Average of Parents	44.0			84.2	245.1
Average of Best Parents	49.5				

In 1920 Cocke's Prolific was the male parent of the first generation crosses tested. That year the average yield of the crosses exceeded that of the parents by 3.5 bushels per acre but the average of the better yielding parent in the different crosses was 5.5 bushels more than the average of the crossed strains. In seven cases out of eight, the Cocke's Prolific parent was the better yielding parent. This variety appears to be well adapted to the region where the tests were conducted and produces well. Apparently its production could not be increased much by crossing.

*Several other varieties were crossed but on account of bad stands the data secured are not considered reliable.

Table XI. Yields of Parent Varieties and Their First Generation Crosses in 1921.

Variety	Plat Yield in Lbs.	% Gain Over Av. of Parents	% Gain Over Best Yielding Parent	Days from Plant'g to Silking	Average Height of Stalk in d. c.	Average Width of Blade in c. m.	Average No. Rows of Kernels in Ear	Length of Ears in d. c.
Cocke's Prolific	227.5			86	29.2	8.6	12.6	19.5
Cocke's Prolific X Cock's Prolific	245.0	+7.7	+7.7	84	29.9	9.2	12.6	19.7
Jones Prolific	233.0			82	27.6	8.5	13.4	16.2
Jones Prolific X Cocke's Prolific	253.0	+6.1	+3.7	81	28.8	8.5	12.8	18.6
Cocke's Prolific	244.0			86	29.8	8.8		
Alabama Yellow	198.0			83	27.4	9.0	14.6	20.1
Alabama Yellow X Cocke's Prolific	249.0	+12.7	+2.0	83	28.8	9.0	14.2	20.2
Mosby	214.5			86	28.8	8.3	13.6	19.5
Mosby X Cocke's Prolific	225.5	—2.0	—18.3	86	29.7	8.5	13.7	20.3
Cocke's Prolific	246.0			86	29.9	8.3		
Vardaman	197.0			88	28.9	8.0	14.3	18.8
Vardaman X Cocke's Prolific	220.0	—0.7	—10.6	85	30.7	8.0	13.6	19.1
Paymaster	257.5			79	25.9	10.1	13.6	17.6
Paymaster X Cocke's Prolific	264.0	+9.7	+2.1	81	29.5	10.0	13.3	18.7
Cocke's Prolific	224.0			86	31.6	10.5		
Tennessee Red Cob	216.0			85	31.6	10.3	14.0	19.2
Tennessee Red Cob X Cocke's Prolific	235.5	+7.0	+5.1	84	30.2	10.4	13.4	20.4
Shoe Peg	158.5			88	28.5	10.1	19	16.3
Shoe Peg X Cocke's Prolific	200.5	+2.5	—9.9	89	29.9	10.1	15.2	17.4
Cocke's Prolific	222.5			87	29.2	9.9		
Hickory King	170.0			77	27.4	8.9	8.7	18.3
Hickory King X Cocke's Prolific	215.5	+9.8	—3.1	83	29.0	9.4	11.0	20.4
Iowa Gold Mine	197.0			84	26.5	9.9	15.5	18.6
Iowa Gold Mine X Cocke's Prolific	226.5	+8.8	+3.2	85	28.3	10.2	14.0	20.2
Cocke's Prolific	219.5			86	29.7	9.8		
Florida Flint	183.0			82	28.9	9.4	14.7	17.5
Florida Flint X Cocke's Prolific	224.0	+11.3	+2.1	81	29.0	10.1	13.5	18.2
Johnson Co. White	195.0			78	28.1	9.6	17.4	20.3
Johnson Co. White X Cocke's Prolific	211.5			82	28.4	10.0	14.8	20.3
Cocke's Prolific	232.0	—0.9	—8.9	87	29.5	10.2		
Laguna	237.5			87	29.0	10.5	14.7	19.7
Laguna X Cocke's Prolific	263.0	+12.1	+10.7	87	29.5	10.2	13.5	19.6
Goliad	203.0			94	30.8	10.6	13.6	20.2
Goliad X Cocke's Prolific	238.0	+9.4	+2.6	90	30.3	10.4	13.2	19.7
Average of Crosses	233.6	+14.4	—0.1	82.9	29.43	9.57	13.49	19.49
Average of Parents	204.1			84.8	29.17	9.48	13.43	19.10
Average of Best Parents	233.9							

In 1921 Cocke's Prolific was again the male parent of the first generation crosses tested. Eleven of the fourteen crosses outyielded the average of their parents and nine of the crosses made better yields than either of their parents. Of the higher yielding parents Cocke's Prolific was the leader in twelve of the fourteen trials. The hybrids were intermediate between parents in respect to height, in most instances, but their average exceeded the average of the parents, showing some dominance of the taller parent or some stimulating effect of hybridization. Similar results were noted in the inheritance of width of blade, number of rows of kernels on an ear, and length of ear.

TABLE XII. SUMMARY OF RESULTS.

YEAR	Average Yield of Crosses Compared with Average of Parents	Male or Pollen Parent	Average yield of Crosses Compared with Average of Higher Yielding Parents	Best Yielding Cross Compared with Best Yielding Parent in Test	Best Yielding Cross	Best Yielding Parent
1913	+8.2%	Mosby	+2.4%	+4.3%	Fla. Flint X Mosby	Fla. Flint
1914	+4.6%	Mosby	−1.4%	+2.8%	Vardaman X Mosby	Cocke's Prolific
1915	+4.4%	Mosby	+2.1%	+3.1%	Fla. Flint X Mosby	Vardaman
1916	+8.6%	Mosby	+3.3%	+1.3%	Jones Prolific X Mosby	Boone Co. White
1917	+1.8%	Vardaman	−4.3%	−3.5%	Johnson Co. White X Vardaman	Vardaman
1918	+5.8%	Jones Prolific	+2.5%	+2.5%	Vardaman X Jones	Vardaman
1919	−10.4%	Fla. Flint	−12.7%	−7.7%	Ala. Yellow X Fla. Flint	Cocke's Prolific
1920	+7.9%	Cocke's Prolific	−4.0%	−6.6%	Hickory King X Cocke	Cocke's Prolific
1921	+14.4%	Cocke's Prolific	−0.1%	+2.7%	Paymaster X Cocke	Paymaster
Average	+5.2%		−9.9%	−1.1%		

Summary Of Results From Crossing Tests.

Table XII brings together the most important results secured during the nine years the crossing experiments were conducted. From a study of this table and preceding ones it is evident that first generation crosses of corn varieties such as are grown in Mississippi and in other Southeastern states will yield more than the average of their parents. The crosses exceeded the average of their parents eight years out of nine. When compared with the average of the better yielding parent in the various crosses the hybrids did not make such a good showing

for the better parents outyielded the crosses five years of the nine that studies were made. When the best yielding hybrid combinations are compared wth the best yielding individual parents different years they make a somewhat better showing since they outyielded the highest yielding parent in the test six years out of the nine. From the point of view of practicability, this is the most important test. If the cross will not outyield every parent in the test there is no advantage to be gained in growing it. The high yielding parent could be grown instead. It appears, however, that the crossing of varieties will give gains rather consistently, if proper combinations are made, but that the trouble required is so great that it is not worth while provided an oustanding variety such as Vardaman was, during the years 1915 to 1918, or Cocke's Prolific from 1919 to 1921, is available for planting.

Crossing varieties or strains that have been inbred, or with which close breeding has been practiced, is helpful. This is shown by Tables IV and VII.

It is probable that the success of the cross depends on the characteristics of the varieties that are used, but not enough study has been given this matter to reach any very definite conclusions. It appears that a very radical cross like Tennessee Red Cob X Florida Flint is not satisfactory, but that crossing a semi-flint variety like Cocke's Prolific, Jones Prolific, or Alabama Yellow with a variety that has a larger, somewhat rough ear, like Boone County White, Florida Flint, or Mosby, may give good results.

There are doubtless many different factors which have an influence on the performance of any particular cross or hybrid combination of varieties, the selection and breeding they have received, etc. Certain planting, the acclimitization of the varieties, characteristics of the varieties, the selection and breeding they have received, etc. Certain combinations made a good showing some years and not others.

The results obtained appear to be consistent and they agree, in general, with the results from similar experiments conducted in other states. Somewhat larger gains from the crossing were secured by some other investigators but on the whole, the figures are comparable.

The characters measured were in the main, intermediate between those of their parents with an average slightly above the average of the parents. This was probably due to increased vigor following the hybridization. The hybrid progenies were found to exceed the average of their parents in height, leaf area, leaf width, length of ear, number of rows of kernels on an ear, and percentage of grain. The hybrids appeared to gain in earliness some years but were later than their parents other years. No conclusion in respect to this character can be drawn from the data at hand.

Natural Crossing In A Field Of Corn

As has been seen, self, or close pollination has a harmful effect on

the vigor and yield of corn plants. To prevent this, nature has provided for cross pollination. Large quantities of pollen are produced in the tassels at the top of the plants where it is easily caunght by the wind and carried some distance. On most plants pollen is being shed several days, say three to six, before the silk appear. By the time the silks are ready for pollination the pollen that the stalk produced is about gone. It has been found, too, that pollen from another plant is more active in bringing about fertilization than the pollen from the same plant. In some tests made by the writer where silks were first self pollinated, and then a minute or two later cross pollinated, 80.3 per cent of the kernels were crossed.

Waller (15) found, by planting hills of a white variety about over a field of yellow corn that only 5.13 per cent of the grains of corn were self fertilized.

In an experiment made by the writer two pure varieties, one yellow and the other white, were planted side by side in a small field. The rows ran north and south and the prevailing wind was from the southwest. Five ears were taken at random from each row in the field, grains counted and percentage of each color determined. There were ten rows of the yellow corn and thirty-seven of the white. Beginning with the row of the yellow corn next to the white rows the percentage of crossed grains ran as follows: first row, 28.5 per cent; second row 13.0 per cent; third row, 13.3 per cent; fourth row, 8.2 per cent; fifth row, 10.8 per cent; sixth row 7.5 per cent; seventh row, 7.5 per cent; eighth row, 5.9 per cent; ninth row, 8.6 per cent; and tenth row, 10.1 per cent. Starting with the row of white corn next to the yellow plat, the percentage of crossed grains in the several rows was as follows: first row, 19.4 per cent; second row, 13.2 per cent; third row, 6.8 per cent; fourth row, 3.3 per cent; fifth row, 2.4 per cent; sixth row, 1.5 per cent; seventh row, 3.1 per cent; eighth row, 0.7 per cent; ninth row, 1.0 per cent; tenth row, 1.2 per cent; eleventh row, 0.4 per cent; fifteenth row, 0.3 per cent; twentieth row, 0.15 per cent; twenty-fifth row, 0.06 per cent; thirtieth, 0.2 per cent; thirty-first, 0.0 per cent; thirty-fifth, 0.18 per cent. From these figures it appears that there is considerable crossing between adjoining rows but with separation the percentage falls rapidly. There was a small amount of crossing at the greatest degree of separation used in the experiment. Probably this or a lesser amount might take place at a much greater distance.

SELECTION IN AND CROSSING PURE LINES

Judging from results published recently by various investigators it appears that the limit of corn improvement by the usual methods has about been reached. In other words, it is a very difficult task to increase the yield of our best varieties by mass selection, ear-to-row work, or by variety crossing. A new method of breeding known as selection in and crossing of pure lines gives promise of some further increase and is

attracting the attention of most of the corn breeders of the country. The method, in brief, is as follows; certain plants of some one or more well established varieties are self pollinated by hand. Progenies are grown from the self fertilized ears by planting each in a separate row Some of the best plants in the rows are again self pollinated and more progenies grown the following year. This process is continued until comparatively pure strains are produced. From the self-fertiliziation, or inbreeding, there results a rapid deterioration in size, vigor, and in yielding power of the plants—See figures 1, 2, and 3.

Fig. I Effect of Inbreeding on Corn Rows (1) and (2) Ala. Yellow Self Pollinated 2 years. Rows (3) and (4) Tenn. Red Cob crossed with Ala. Yellow. Row (5) Ala. Yellow, open pollinated.

When the strains become pure, genetically considered, the deterioration ceases and fixed strains with very uniform qualities are secured. These pure line strains differ from each other greatly; some are decidedly more vigorous and better yielders than others, but even the best are usually poor yielders when compared with the best of our commercial varieties or with the original strain as it was before being selfed.

Nearly all of the inbred strains when crossed regain their former vigor and yielding power and some, when crossed in certain combinations, yield more than the original strain, and even more than our best varieties. See figure 2.

Fig 2. Effect of Inbreeding and Crossing Inbred Strains. (From left to right): (1) Jones' Prolific, open pollinated. (2) A first generation cross of two inbred strains of Jones' Prolific. (3) Jones' Prolific, self pollinated two years.

The reduction to purity in the inbreeding process appears to bring to surface, or to make visible, all the characters that a strain car-

ries. A hybrid strain may carry some inferior qualities in a latent form. The pure line strains that show inferior characters may be discarded. In fact, many of them are so weak, or produce so poorly that they will not reproduce themselves, and there is an elimination by natural means. Hybrids resulting from the crossing of strains possessing only desirable characters are sure to have only good qualities. Producing varieties of this sort is the goal of corn breeding.

Results From Pure Line Cross Breeding

This new method of corn breeding is of comparatively recent origin and there is yet only a limited amount of data from experiments that have been conducted. The method has not yet passed into commercial use to any extent.

East, Hays, and Jones of the Connecticut Experiment Station were pioneers in the development of this new method of corn breeding and to that Station we may go to get valuable data. Jones and Mangelsdorf (16) give the following table which shows the comparative yields of parent strains, selfed strains and single and double crosses of selfed strains. The parent varieties used were native varieties of Connecticut and were well adapted. The inbred strains were self-fertilized four years before being crossed. The double cross was made by making crosses between two first generation crosses of selfed strains.

VARIETY OR CROSS	YIELD IN BUSHELS PER ACRE
Century Dent, 110	47.5
Leaming, 112	44.4
Inbred Century Strain, 110-2	15.3
Inbred Century Strain, 110-4	16.8
Inbred Leaming Strain, 112-1	42.7
Inbred Leaming Strain, 112-4	11.1
Single Cross, 110-2 x 110-4	51.2
Single Cross, 112-1 x 112-4	45.6
Double Cross, (110-2 x 110-4) x (112-1 x 112-4)	69.8

The double cross shown in the above table made a remarkable gain in yield over both of the original parent strains. Another double crossed strain known as the Burr-Leaming Double Cross yielded more, in Connecticut tests, than any other variety in the tests three years out of five. There was also less mold on the ears, fewer nubbins, and less soft corn.

Richey and Mayer in Tennessee, as reported by Hayes (17), secured three crosses that averaged 30 per cent better yield than the parent variety.

In Nebraska, Kiesselbach (4) secured one single cross that produced 53.2 bushels per acre as an average for four years while the original variety produced but 41.2 bushels.

Prof. Hughes of Iowa, as quoted by Hayes (17) says: "From results secured thus far it is entirely evident that decidedly better yields

can be secured from hybridizing pure lines than can be had from the best standard varieties which we know. The data would also indicate that extensive ear-row breeding with subsequent crossing of the best lines even when carried through a long period of years, can not be expected to give the results to oe had from the production of pure lines and the use of F. seed."

From experiments conducted in Minnesota, Hayes (17) reports one double cross that outyielded the commercial varieties by 30 per cent; seven that led by 13 per cent and three that were below the commercial varieties in yield.

Fig. 3. Effect of Imbreding Corn. (From left side): (1.) Laguna, open pollinated. (2.) Laguna, self pollinated 1 year. (3.) Paymaster, open pollinated. (4.) Paymaster, self pollinated 1 year.

Selections in Pure Lines in Mississippi

Prior to 1922 the writer grew at the Mississippi Experment Sta-

tion something more than a hundred pure line strains of southern varieties. These were self pollinated one to four years. The effect of the in-breeding appeared to vary some with different varieties, the better producing ones seeming to deteriorate less rapidly than others, and the effect varied greatly with different strains selected within a single variety.

In all cases there was a reduction in vigor, size of stalk, and in yielding capacity. The selfed strains as a rule yielded less than one half as much as the parent strain and in a number of instances not enough viable seed was produced to propagate the strain. With many of the strains, germination was poor, and the young plants weak. Various abnormalities were observed, such as very slender plants, slender blades, striped blades, young plants lacking chlorophyll, dwarf plants, plants with leaves lacking ligule, plants with leaves that did not unfurl properly, plants with zigzag internodes, and various tassel and ear abnormalities. The inbred plants were found to be more susceptible to diseases, and less drought resistant than normal plants. Most of the strains showed marked uniformity after being self pollinated two or three years.

Trial crosses were made between strains that had been inbred one to three years. Some of these gave yields less than the original parent strains while others showed considerable gains. This work has been continued by the Experiment Station. Data showing in detail results obtained will be published later.

Single Crosses.

Theories concerning the advantage to be gained by making a cross between two selfed or pure line strains were given on a preceding page, and the advantage to be gained in the shape of increased yields was mentioned. A serious disadvantage in the use of the single cross seed of pure lines is found in the fact that the F. seed produced when the two selfed lines are crossed is somewhat faulty. The selfed strains commonly have ears that are reduced in size and they have small kernels. These small kernels are weaker in germination and the yield of seed per acre is considerably less than a good commercial variety.

Double Crosses

It was suggested by Professor Jones, of Connecticut, that in order to overcome the drawbacks of single crosses mentioned above crosses might be made of two single cross strains thus producing a double cross. Some of the double crosses that have been tried out in experiments gave yields somewhat better than the single crosses and they met the objections made against the small seed of the latter. Large ears were obtained from the crossed single plants.

The double cross system, however, is also open to some objections. In order that a farmer may have seed of this sort to plant, some one must propagate and keep pure at least four different pure line

strains. Some one must make first generation crosses, or single crosses, of both pairs of the pure line strains, and then these first generation strains must be crossed. The seed of the double cross is not fit to plant. Corn grown from it will not yield well. New crosses have to be made for each crop. Very large gains will have to be made to pay for all of this trouble. The individual farmer can not well do all the work necessary. The Experiment Stations can not carry on commercial work and it is doubtful if the professional seedman could sell the double crossed seed for enough increase in price over the price of the seed of good commercial varieties to pay them for the extra trouble. In the Corn Belt where much interest is taken in growing good varieties of corn, such seed might be sold at a fancy price but we doubt if it could be sold in quantity in the South.

Multiple Crosses

A third system of crossing pure line strains of corn, one designed to meet objections to the other systems and to be of value to the practical grower, is known as the multiple cross system. This system as described by Professor Jones (16) is as follows:

"A number of the best inbred strains of a variety are permanently combined into a fairly uniform type that can be propagated from year to year by natural inter-crossing, as are ordinary varieties. In other words, a 're-created' variety is produced in which all the best of the old variety has been combined and all the inherited abnormalities and weaknesses have been eliminated.

"This recreated variety is now crossed with a similar combination of the best inbred strains from some other sort or perhaps a group of inbred strains of different type from the same variety.

"Such a multiple cross would have the advantage of producing good yields of well developed seed and crossing each year would give maximum vigor and productiveness. This method has not been thoroughly tested but preliminary tests indicate that it will be feasible. The uniformity of the crossed plants produced by this method may not be as great as in a double cross, but if the right combination of strains is made, yield should be maintained at a high level indefinitely."

As was mentioned by Professor Jones, the multiple cross system has not been tried out thoroughly but some few investigators have obtained encouraging results. It is possible that either this method or some modification of it may be devised which will be of value to the practical corn grower.

SUMMARY

1. Mass Selection is a simple method of corn breeding which has given good results.

2. Ear-to-row corn breeding work carried on in Mississippi for ten years gave no consistant increase in yields.

3. First generation crosses of standard varieties of corn yielded better than the average of their parents in most instances, and better than the best yielding parent in a much smaller percentage of cases.

4. In the tests carried on for nine years the gain of the first generation crosses over the better yielding parent was so slight that it is doubtful whether their use would be practicable.

5. Inbreeding corn plants resulted in marked reduction in size, vigor, and yielding power.

6. Crossing inbred strains brought back vigor and yielding power. Some of the crossed inbred strains yielded more than the original parent strain.

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PROGRESS REPORT

ON

COST OF PRODUCTION ROUTE IN CHOCTAW COUNTY, MISSISSIPPI, 1925

By
LEWIS E. LONG, Research Economist
and
H. W. REYNOLDS, Route Man

United States Department of Agriculture
Bureau of Agricultural Economics

In Cooperation With

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi

J. R. RICKS, Director

PROGRESS REPORT
ON
COST OF PRODUCTION ROUTE IN CHOCTAW COUNTY, MISSISSIPPI, 1925

This report is for the calendar year 1925, the second year of a three year study. A report of the work for 1924 is contained in Miss. Station Bulletin 228, by J. N. Lipscomb, Farm Economist, and H. A. Byrd, Route man.

Records from nineteen farms are included in this report 1/. The crop season of 1925 was abnormally dry, a condition especially favorable for cotton, but unfavorable for corn and feed crops. Because of the dry season, the yield of corn was reduced and most of the lespedeza hay was too short to cut. Pastures were also short. This condition, together with good cotton prices, makes cotton a more profitable farm enterprise than would probably be the case for a normal season. Similar conditions in 1924 had brought about some reduction in other enterprise which still further focuses attention on cotton. Although cotton has been the most profitable enterprise for the past two years, most of our cooperators realize that the seasons were abnormal and that wisdom lies in not sacrificing all other enterprises for cotton growing.

The study is being continued during 1926. It is the intention, when the year's records are complete, to publish a detailed report covering the three year's study.

The nineteen farms considered in this study are designated by numbers from 1 to 19. The same number applies to the same farm throughout, although different tables are arrayed on different bases. Table 1 is arrayed on the basis of per cent return on investment and was used in assigning the permanent number designations.

1/. The farmers cooperating were G. W. Blain, W. W. Bond, J. L. Bruce, C. W. Coleman, F. S. Coleman, F. T. Coleman, J. E. Drane, R. H. Henderson, J. P. Irving, W. M. Kennedy, B. F. King, H. D. King, R. S. King, R. J. McKnight, D. W. Paisley, T. M. Pyron, J. H. Prewitt, T. A. Patterson, E. B. Smith, J. M. Smith, H. R. Smith, Ward & Keene, J. D. Worrell, and M. E. Worrell.

Table 1 FINANCIAL STATEMENT

Arrayed on per cent return on investment.
19 Farms, Choctaw Co., Miss. 1925

Farm Number	Total Investment Dollars	Crop and Livestock Receipts Dollars	Miscel. Receipts 1/ Dollars	Increase in Inventory Dollars	Val. Items Furnished the Home Dollars	Total Val. of Products Dollars
1	1600	564.45	84.00	.....	391.64	1040.09
2	2499	611.89	358.90	448.87	341.36	1761.02
3	3112	790.25	365.15	.....	550.93	1706.33
4	5378	673.87	652.64	688.65	449.60	2464.76
5	4259	813.12	472.40	348.38	512.18	2146.08
6	3488	614.95	190.00	.....	402.87	1307.82
7	3412	728.12	111.21	.....	410.07	1249.40
8	8583	3028.38	100.00	.....	576.94	3705.32
9	4522	717.77	467.44	308.70	302.51	1796.42
10	3637	1189.42	190.78	23.53	362.58	1766.31
11	7985	803.09	967.93	.....	686.88	2457.90
12	5844	1097.13	.....	.....	575.42	1672.55
13	4145	543.51	70.35	.....	340.68	954.54
14	3234	635.37	421.40	.....	374.54	1431.31
15	2566	305.17	5.00	.....	491.08	801.25
16	3486	822.09	309.30	.....	467.62	1599.01
17	3961	692.36	11.50	.....	500.07	1203.93
18	3343	897.90	213.50	620.33	762.87	2494.60
19	4500	726.10	218.50	.....	703.48	1648.08
Weighted Average	4187	855.52	274.21	128.34	489.65	1747.72

1/ Includes labor off the farm.

2/ The difference between Farm Income and Value of Operator's Labor multiplied by 100 and the result divided by total investment.

Cotton is considered the principal crop of the community. It returns by far the largest part of the cash receipts. Table No. 2 gives the cost of the several items per acre entering into the production of the crop on seventeen farms where wage cotton was produced, together with the seed credit, yield per acre, and cost per pound of lint. The usual method of crediting the seed and dividing net cost per acre by lint yield to obtain the cost per pound has been followed rather than undertake the working out of joint costs for seed and lint.

A charge for use of land was not computed, and the cost of ginning and wrapping was omitted. An approximation of such charges would be one-third of the crop, for the use of land and five dollars per bale for ginning and wrapping.

Table 1—(Continued)

Cash Expenses Dollars	Decrease in Inventory Dollars	Value of Family Labor Dollars	Total Charge Dollars	Farm Income Dollars	Value of Operator's Labor Dollars	Per Cent Return on Investment2 /
212.91	16.73	.....	229.64	810.45	359.12	28.2
814.65	.....	21.45	836.10	924.92	297.60	24.7
659.27	9.25	.60	669.12	1037.21	310.39	23.4
1109.92	.....	18.22	1128.14	1336.62	309.90	19.1
835.39	.....	177.45	1012.84	1133.24	356.32	18.2
345.69	141.11	5.70	492.50	815.32	320.02	14.2
208.37	235.05	15.22	458.64	790.76	320.92	13.8
1916.99	55.45	90.00	2062.44	1642.88	474.07	13.6
663.26	.....	314.10	977.36	819.06	237.94	12.9
569.74	.....	522.45	1092.19	674.12	211.85	12.7
354.99	818.75	.....	1173.74	1284.16	289.69	12.5
389.13	340.45	10.62	740.20	932.35	293.47	10.9
115.31	164.73	.....	280.03	674.51	294.07	9.2
186.64	323.25	306.00	815.89	615.42	330.82	8.8
193.71	222.65	.....	416.36	384.89	196.65	7.3
800.38	206.45	.....	1006.83	592.18	377.70	6.2
244.24	360.64	222.90	827.78	376.15	147.86	5.8
1299.42	.....	657.05	1956.47	538.13	429.52	3.2
565.36	591.80	198.65	1355.81	292.27	386.44	-2.1
604.49	183.49	134.76	922.74	824.98	312.86	12.2

The principal factors conducive to low cost per pound are low costs for man labor and horse work, with high seed credit and yield of lint. Of three farmers showing the lowest cost per pound, two were prominent in all four factors while one overcame high man labor and horse work costs with exceptionally high seed credit and yield. All three produced a pure variety of cotton which enabled them to sell most of their seed for planting purposes at a premium, a practice which more farmers might profitably follow.

Table 3 shows the man labor and horse work, by operations, expended in the production of cotton. Generally, those having the lowest costs devoted less than the average amount of labor to the several operations. The season was such that labor requirements were relatively light. Labor costs for efficient production would be greater for a year of normal or abnormal rainfall.

With the exception of man labor and horse work, fertilizers constituted the largest single item of expense on cotton and corn. The kinds and amounts of fertilizer applied to these two crops are shown in Table 4. No barnyard manure was used for corn, while only a small amount was applied to cotton land. There was practically no weevil or worm damage; cotton opened very early; and those having small or medium sized crops were able to save the entire crop in first class condition. The year was unfavorable for corn, and although those having corn on choice lands made favorable yields, the season was so dry that such fertilizer as was applied to corn land failed to yield its maximum benefits.

Table 5 shows the cost per acre and per bushel for corn production. The average yield per acre of 16.7 bushels was very good for a dry season, although it was somewhat below the average of 18 bushels for the community in 1924.

Table 2 COTTON—COST PER ACRE AND PER POUND LINT
Arrayed on cost of producing lint
17 Farms—Choctaw County—1925

Farm Number	Man Labor Dollars	Horse Work Dollars	Fertilizers Dollars	Other Costs Dollars	Gross Cost(1) Dollars	Seed Credit Dollars	Net Cost Dollars	Yield per Acre Pounds	Acres Grown Number	Cost per Pound Cents
7	12.79	3.97	2.87	2.96	22.59	10.41	12.18	350	4.9	3.5
13	10.59	4.82	2.70	1.23	19.34	10.28	9.06	257	6.8	3.5
11	20.43	13.73	1.05	2.21	37.42	17.50	19.92	555	1.0	3.6
2	7.76	3.09	4.13	1.61	16.59	7.99	8.60	222	8.7	3.9
4	6.66	4.00	3.07	1.76	15.49	5.06	10.43	179	11.2	5.8
3	10.40	4.36	4.42	2.05	21.23	4.22	17.01	232	8.8	7.3
6	10.86	2.43	4.00	1.27	18.56	4.76	13.80	176	5.1	7.8
14	11.48	5.83	3.71	1.63	22.65	5.90	16.75	197	16.0	8.5
15	25.24	8.22	5.97	3.21	42.64	9.96	32.68	353	1.1	9.3
5	18.40	5.11	6.47	2.31	32.29	6.14	26.15	245	12.1	10.7
19	18.64	5.68	3.59	1.43	29.34	4.51	24.83	221	13.3	11.2
12	34.56	9.19	11.62	3.32	58.69	9.40	49.29	414	3.8	11.9
16	11.28	4.95	2.78	1.34	20.35	3.66	16.69	136	11.8	12.3
18	20.19	4.37	3.05	2.08	29.69	4.48	25.21	178	19.0	14.2
10	22.82	5.28	5.52	1.38	35.00	2.62	32.38	228	23.0	14.2
9	13.28	8.85	3.07	1.37	26.57	3.62	22.95	159	17.6	14.4
17	26.40	12.37	5.35	3.31	47.43	4.50	42.93	264	4.0	16.3
Wt. Av.	15.69	5.54	4.12	1.76	27.11	5.18	21.93	214	9.9	10.2

(1) Exclusive of charge for use of land.

able 3

COTTON—MAN LABOR PER ACRE

Arrayed on cost of producing lint

Farm Number	Acres Grown Number	Land Preparation Hours	Applying Fertilizer Hours	Harrow and Plant Hours	Cultivate Hours	Hoe and Chop Hours	Pick Hours	Haul to Gin Hours	Total Hours	Yield Lint Pounds
7	4.9	8.8	3.9	6.5	12.4	18.6	32.2	2.9	85.3	350
13	6.8	4.2	1.1	2.2	12.8	9.4	37.1	3.7	70.6	257
11	1.0	10.5	.....	9.0	16.0	18.2	74.0	7.0	136.2	555
2	8.7	3.9	1.8	2.0	10.6	14.1	16.4	2.9	51.7	222
4	11.2	3.7	1.9	8.6	7.0	10.5	7.8	4.9	44.4	179
3	8.8	9.2	1.7	5.1	11.0	19.6	18.4	3.9	68.9	232
6	5.1	3.1	1.2	1.5	10.7	14.9	39.2	1.8	72.4	176
14	16.0	11.6	1.5	3.0	12.5	17.7	26.4	3.8	76.5	197
15	1.1	3.6	8.2	18.2	36.4	21.0	78.2	2.7	168.3	353
5	12.1	5.1	3.7	3.3	14.0	32.5	61.5	2.6	122.7	245
19	13.3	5.5	2.2	2.7	19.3	35.3	56.5	3.7	124.3	221
12	3.8	37.9	19.0	3.4	31.8	59.0	77.4	1.9	230.4	414
16	11.8	11.1	1.2	7.6	15.2	20.8	18.9	.4	75.2	136
18	19.0	18.5	4.1	4.1	16.9	24.3	64.0	3.2	134.6	178
10	23.0	10.0	3.7	3.9	12.9	37.3	82.7	1.6	152.1	228
9	17.6	11.8	4.3	4.3	16.4	17.9	30.7	3.1	88.5	159
17	4.0	24.0	.....	4.5	33.5	41.8	68.5	3.7	176.0	264
t. Av.	9.9	10.2	3.1	4.4	14.8	24.4	44.7	2.9	104.5	214
				Horse Work per Acre						
7	4.9	12.6	4.9	7.6	12.4	.....	.....	5.6	43.1	350
13	6.8	5.1	1.2	2.2	12.8	.....	.....	7.4	28.7	257
11	1.0	15.5	.....	9.0	16.0	.....	.....	12.0	54.8	555
2	8.7	3.9	2.0	2.0	10.6	.....	.....	5.8	24.3	222
4	11.2	3.7	1.9	8.6	7.0	.....	.....	9.8	31.0	179
3	8.8	11.3	.....	5.4	11.0	.....	.....	7.8	35.3	232
6	5.1	6.2	.6	1.5	10.2	.....	.....	3.6	22.1	176
14	16.0	12.0	.....	3.0	12.5	.....	.....	7.6	36.9	197
15	1.1	7.2	8.2	18.2	36.4	.....	.....	5.4	75.4	353
5	12.1	5.6	.2	3.3	14.0	.....	.....	5.3	28.4	245
19	13.3	5.4	.....	3.0	19.3	.....	.....	6.1	33.8	221
12	3.8	37.9	15.0	3.4	31.8	.....	.....	3.8	91.9	414
16	11.8	18.0	.....	7.6	15.2	.....	.....	.8	41.6	136
18	19.0	18.5	.8	4.1	16.9	.....	.....	4.8	45.1	178
10	23.0	10.0	.4	3.9	12.9	.....	.....	2.8	30.0	228
9	17.6	11.8	.7	3.6	16.4	.....	.....	3.9	36.4	159
17	4.0	26.0	.....	4.5	33.5	.....	.....	7.5	71.5	264
t. Av.	9.9	11.5	1.1	4.3	14.8	.....	.....	5.3	37.0	214

Table 6 shows by operations the man labor and horse work expended on the corn crop. It will be noted that equal amounts of labor and work were expended for many of the operations, indicating that one-horse implements were used. Since the study was instituted, the cooperating farmers have been encouraged to make greater use of two-horse implements. A few have adopted such a policy and others have signified their intention of doing so. With two-horse implements, the same acreage of cotton could be handled and more time would be left to the second and third best paying crops.

Tables 7 and 8 show the cost of producing oats and the distribution of labor on the crop, respectively. Years ago, oats were a common crop in the community and some crops have been known to yield 60 bushels per acre. At present only a few farmers grow oats and these grow them in small acreages. The

Table 4

FERTILIZERS—KIND AND AMOUNT PER ACRE ON COTTON AND CORN
Arrayed on Costs per Unit
Choctaw County—1925

Cotton—17 Farms						Corn—19 Farms				
Farm Number	Acres Grown Number	Barnyard Manure Tons	Acid Phosphate Pounds	Nitrate of Soda Pounds	Mixed Pounds	Farm Number	Acres Grown Number	Acid Phosphate Pounds	Nitrate of Soda Pounds	Mix Pour
7	4.9	.5	180.0	.....	20.0	7	17.8	11.2	.....	....
13	6.8	....	116.5	58.2	.....	12	8.0	175.0	.....	....
11	1.0	....	.....	.....	70.0	2	10.3	48.5	39.0	....
2	8.7	.4	92.0	57.5	57.5	4	9.4	95.2	.....	....
4	11.2	....	133.6	44.5	44.5	1	10.1	.....	.....	....
3	8.8	.3	171.0	.....	148.0	13	10.6	28.3	.....	19.
6	5.1	....	150.0	75.0	.....	3	11.2	.....	54.0	....
14	16.0	.2	169.0	31.0	61.0	5	11.0	54.5	18.0	....
15	1.1	....	205.0	145.0	.....	14	17.1	64.3	.....	....
5	12.1	....	256.0	149.0	.....	8	23.0	26.1	.....	17.
19	13.3	....	180.0	71.0	.....	17	18.5	68.0	.....	....
12	3.8	3.4	210.0	105.0	.....	6	7.2	41.7	13.9	....
16	11.8	....	127.0	60.0	.....	15	1.7	177.0	.....	....
18	19.0	....	166.0	52.0	.....	10	9.2	.....	.....	....
10	23.0	....	.....	42.0	261.0	11	3.8	.....	.....	13.
9	17.6	....	176.0	53.0	.....	9	11.4	79.0	.....	....
17	4.0	....	225.0	112.0	.....	18	17.5	.....	4.3	....
						19	13.2	174.0	.....	....
						16	6.9	.....	.....	145.
Wt. Av.	9.9	.2	144.1	57.3	56.3	Wt. Av.	11.5	48.9	6.3	7.

usual practice in the community is to cut and bind the oats by hand and feed them in the bundle. Yields were, therefore, estimated. With the low yields produced, oats are shown to be a profitable feed crop and when the pasture and cover crop values are considered, it is evident that farmers of the community could profitably grow more of them. Labor for oat production interferes very little with the production of cotton and corn, while the growing of both oats and corn gives a double chance of producing the grain feed for the farm.

Only four crops of sorghum—three individual crops and one partnership crop—were utilized for syrup in 1925. Table 9 shows the cost per gallon of syrup, while Table 10 shows the labor and work expenditures. Seed was credited against cost of syrup which greatly reduced the cost per gallon. Considerable sugar cane was formerly grown in the community, but drouth

ble 5 CORN—COST PER ACRE AND PER BUSHEL
Arrayed on Cost of Producing Grain
19 Farms—Choctaw County—1925

arm mber	Man Labor Dollars	Horse Work Dollars	Ferti-lizers Dollars	Other Costs Dollars	Gross Cost (1) Dollars	Fodder & Pasture Credit Dollars	Net Cost Dollars	Yield per Acre Bushels	Acres Grown Number	Cost per Bushel Dollars
7	3.90	2.31	.09	.07	7.00	.....	7.00	22.1	17.8	.32
12	10.22	6.38	1.49	1.47	19.56	.66	18.90	43.0	8.0	.44
2	3.21	1.89	1.54	.47	7.11	.....	7.11	14.1	10.3	.50
4	3.42	3.02	.83	.65	7.92	1.16	6.76	13.2	9.4	.51
1	4.28	3.51	.....	.64	8.43	.....	8.43	14.8	10.1	.57
13	4.06	3.90	.53	.61	9.10	.....	9.10	12.7	10.6	.72
3	4.62	2.99	1.57	.67	9.85	.....	9.85	13.7	11.1	.72
5	6.36	5.40	1.00	.83	13.59	.18	13.41	18.2	11.0	.74
14	5.12	3.79	.55	.66	10.12	.....	10.12	13.1	17.1	.77
8	6.99	5.38	.48	1.07	13.92	.90	13.02	16.4	23.0	.79
17	5.26	4.74	.57	.74	11.31	.....	11.31	13.5	18.5	.84
6	7.74	4.70	.77	1.02	14.23	.....	14.23	16.7	7.2	.85
15	23.02	17.77	1.55	3.25	45.86	.....	45.86	46.5	1.7	.99
10	7.50	5.23	.....	.79	13.52	.....	13.52	13.6	9.2	.99
11	11.18	18.15	.19	1.67	31.19	4.00	27.19	26.9	3.8	1.01
9	9.64	10.21	.67	1.04	21.56	.....	21.56	21.0	11.4	1.03
18	8.10	3.96	.12	1.03	13.21	.....	13.21	12.4	17.5	1.06
19	7.29	6.27	1.53	1.07	16.16	.....	16.16	14.4	13.2	1.12
16	5.19	4.40	2.76	.92	13.27	.....	13.27	8.7	6.9	1.52
..										
.	6.24	4.89	.74	.88	12.74	.25	12.49	16.7	11.5	.75

(1) Exclusive of charge for use of land.

Table 6 CORN—MAN LABOR PER ACRE
Arrayed on Cost of Producing Corn

Farm Number	Acres Grown Number	Land Preparation Hours	Applying Fertilizer Hours	Harrow and Plant Hours	Cultivate Hours	Hoe Hours	Pull and Haul Hours	Total Labor Hours	Yield per Acre Bushels
7	17.8	7.7	....	4.4	5.7	3.1	5.4	26.3	22.1
12	8.0	14.9	2.5	6.0	20.5	11.2	13.0	68.1	43.0
2	10.3	4.1	.....	1.7	7.1	4.2	3.4	21.4	14.1
4	9.4	6.8	.....	4.8	4.9	2.7	3.6	22.8	13.2
1	10.1	6.6	.9	2.9	12.7	4.3	2.3	28.8	15.0
13	10.6	8.6	.8	3.0	8.4	5.2	1.1	27.1	12.7
3	11.2	8.0	.4	4.4	5.7	8.0	4.0	30.5	13.7
5	11.0	6.3	3.1	2.7	9.9	9.3	11.1	42.4	18.2
14	17.1	7.0	.6	4.2	9.1	10.7	2.5	34.1	13.1
8	23.0	11.2	.4	5.8	14.6	6.0	8.6	46.6	16.4
17	18.5	6.6	.....	2.2	13.1	7.1	6.5	35.1	13.5
6	7.2	12.5	1.1	6.9	14.7	10.6	5.8	51.6	16.7
15	1.7	58.2	8.2	21.8	34.1	14.1	17.0	153.4	46.5
10	9.2	10.9	.....	3.9	11.6	19.3	4.3	50.0	13.6
11	3.8	8.1	.5	15.1	14.9	12.0	23.7	74.3	26.9
9	11.4	10.4	.2	11.0	19.1	19.2	4.4	64.3	21.0
18	17.5	9.4	.....	5.4	20.3	10.2	8.7	54.0	12.4
19	13.2	8.1	1.9	3.9	12.5	9.9	12.3	48.6	14.4
16	6.9	2.4	4.3	8.6	6.3	4.3	8.7	34.6	8.7
Wt. Av.	11.5	8.7	.8	5.0	12.0	8.4	6.7	41.6	16.7
				Horse Work per Acre					
7	17.8	11.3	.....	4.4	5.7	.....	3.7	25.1	22.1
12	8.0	23.9	2.5	6.0	22.4	.....	.9	63.8	43.0
2	10.3	4.1	.....	1.7	7.1	.....	2.0	14.9	14.1
4	9.4	8.0	.....	5.0	4.9	.....	5.5	23.4	13.2
1	10.1	8.7	.....	2.9	12.7	.....	1.8	26.1	15.0
13	10.6	10.2	.5	3.0	8.4	.....	1.1	23.2	12.7
3	11.2	10.7	.....	4.9	5.7	.....	3.0	24.3	13.7
5	11.0	8.0	.5	2.7	10.9	.....	7.8	29.9	18.2
14	17.1	8.8	.....	4.3	9.1	.....	1.8	24.0	13.1
8	23.0	15.0	.2	6.5	14.6	.....	5.0	41.3	16.4
17	18.5	8.1	.....	1.9	13.1	.....	4.3	27.4	13.5
6	7.2	15.3	.....	6.9	14.7	.....	5.8	42.7	16.7
15	1.7	88.8	6.5	21.8	34.1	.....	11.8	163.0	46.5
10	9.2	11.5	.....	4.2	11.6	.....	2.4	29.7	13.6
11	3.8	15.4	.....	21.2	17.1	.....	18.2	71.9	26.9
9	11.4	10.7	.....	10.9	19.1	.....	1.3	42.0	21.0
18	17.5	10.4	.....	5.3	20.3	.....	4.9	40.9	12.4
19	13.2	15.2	.....	3.0	12.9	.....	6.2	37.3	14.4
16	6.9	3.5	5.8	11.6	7.4	.....	8.7	37.0	8.7
Wt. Av.	11.5	11.5	.4	5.2	12.2	.....	4.5	33.8	16.7

Table 7 OATS—COST PER ACRE AND PER BUSHEL
Arrayed on Cost of Grain
9 Crops—Choctaw County—1925

Farm Number	Man Labor Dollars	Horse Work Dollars	Fertilizer Dollars	Other Costs Dollars	Total Cost (1) Dollars	Estimated Yield (2) Bushels	Acres Grown Number	Cost per Bushel Dollars
19	1.05	.86	.....	.79	2.70	14.3	3.5	.19
11	.94	2.01	.....	.16	3.11	16.0	1.8	.19
8	1.08	1.09	.....	.97	3.14	10.0	10.0	.31
1	2.30	2.72	.....	1.40	6.42	16.7	3.0	.38
15	1.23	1.31	2.16	2.74	7.44	16.2	4.0	.46
2 & 3	4.80	4.56	.....	2.74	12.10	25.6	1.2	.47
6	1.62	1.76	.....	1.09	4.47	7.7	6.5	.58
4	3.15	3.10	.....	2.88	9.13	9.0	1.0	1.01
14	3.08	4.90	5.76	2.62	16.36	15.0	1.0	1.09
Wt. Av.	1.58	1.75	.45	1.37	5.15	12.5	3.6	.41

(1) Exclusive of charge for use of land.
(2) The usual practice in the community is to feed oats in the bundle.

and inspect pests have caused the crop to be practically abandoned. The few small plantings of sugar cane were handled in the garden account. Although four crops are hardly sufficient in number to justify any conclusions, it appears that sorghum for syrup on a small scale should pay well on the farms of the community and in sections having similar conditions, especially where attention is given to the production of seed as well as to syrup.

Table 11 shows the annual cost per animal unit of workstock and the cost per hour of horse work, while Table 12 shows the annual feed and labor expenditures.

The cost per hour of horse work is governed largely by the cost of feed, depreciation or appreciation, and the total hours worked per animal.

In feeding, grain feed may be greatly reduced when animals are not at work. Farmers of the community are becoming aware of this and lower feed costs are resulting. Considerable interest is also being taken in a better balancing of the feeding rations.

There was an average appreciation of $4.44 per animal for the group of 19 farms which indicated a healthful condition. By

raising colts largely on pasture and rough feeds, working them until they attain their maximum value, and then replacing them with other home produced animals, the item of depreciation will be entirely eliminated from the workstock account. Instead, there would be the cost of keeping young stock which should be kept as low as is consistent with maximum development by employing the feeding method outlined above.

The cost per hour of work was obtained by dividing the total cost, by the hours worked. It is, therefore, evident that the more hours worked per year, the less will be the cost per hour. The total hours worked may be materially increased by planning the cropping system and by using the teams off

Table 8 OATS—MAN LABOR PER ACRE
Arrayed on Cost per Bushel

Farm Number	Acres Grown Number	Land Preparation Hours	Harrow and Sow Hours	Apply Fertilizer Hours	Harvest Hours	Total Labor Hours	Estimated Yield per Acre Bushels
19	3.5	(1)	3.4	.....	3.6	7.0	14.3
11	1.8	(2)	(2)	.....	6.3	6.3	16.0
8	10.0	1.5	1.5	.....	4.2	7.2	10.0
1	3.0	8.7	2.3	.....	4.3	15.3	16.7
15	4.0	2.5	2.2	.5	3.0	8.2	16.2
2 & 3	1.2	7.2	12.0	.....	12.8	32.0	25.6
6	6.5	4.1	2.3	.....	4.4	10.8	7.7
4	1.0	(1)	14.0	.....	7.0	21.0	9.0
14	1.0	(1)	12.0	.5	8.0	20.5	15.0
Wt. Av.	3.6	2.7	3.1	.1	4.6	10.5	12.5
			Horse Work per Acre				
19	3.5	(1)	3.4	.....	1.7	5.1	14.3
11	1.8	(2)	(2)	.....	8.0	8.0	16.0
8	10.0	6.0	1.4	.....	1.0	8.4	10.0
1	3.0	8.7	9.3	.....	2.0	20.0	16.7
15	4.0	5.0	3.0	.....	4.0	12.0	16.2
2 & 3	1.2	14.4	19.2	.....	3.2	36.8	25.6
6	6.5	8.2	4.6	.....	3.2	16.0	7.7
4	1.0	(1)	24.0	.....	.....	24.0	9.0
14	1.0	(1)	31.0	.....	.....	31.0	15.0
Wt. Av.	3.6	5.4	5.4	.....	2.4	13.2	12.5

(1) Included in Harrow and Sow column.
(2) Volunteer crop.

Table 9 LESPEDEZA HAY—COST PER ACRE AND PER TON
Arrayed on Cost per Ton
11 Crops—Choctaw County—1925

Farm Number	Man Labor Dollars	Horse Work Dollars	Other Costs Dollars	Cost per Acre (1) Dollars	Yield per Acre Tons	Acres Grown Number	Cost per Ton Dollars
7	1.50	1.41	.31	3.22	2.0	1.5	1.61
6	.80	1.18	.21	2.19	1.0	3.0	2.19
17	.46	1.07	.12	1.65	.7	2.9	2.41
11	.69	1.86	.09	2.64	1.0	5.9	2.64
12	.62	.76	.15	1.53	.5	6.0	3.05
4	1.35	1.63	.25	3.23	1.0	3.0	3.23
13	1.35	2.35	.28	3.98	1.0	1.0	3.98
8	1.52	2.14	.83	4.49	1.0	8.0	4.49
19	3.28	6.52	.78	10.58	1.9	1.6	5.63
2 & 3	3.00	2.78	13.25	19.03	.4	1.2	47.57
5	1.70	4.54	2.24	8.48	.2	2.3	48.47
Wt. Av.	1.22	2.00	.93	4.15	.9	3.3	4.61

(1) Exclusive of charge for use of land.

the farm for pay during seasons when there is no farm work to be done.

Dairy cattle were kept in the community primarily for family use, and although the cost of producing butterfat was quite high, as shown in Table 13, farmers can ill afford to keep fewer cows than are necessary to supply the family needs. The outstanding methods of reducing the butterfat cost are to reduce the feed cost and increase production. The feed bill may be reduced by substituting home grown feeds for purchased feeds whenever possible, and production increased by better breeding. In general, the better the cows, the more concentrate feed one can profitably feed, and the more concentrate feed fed, the more carefully should the manure be saved. The table shows plainly the relationship between production per cow and cost per pound of butterfat.

Table 14 shows the kinds and amounts of the several feeds fed and the labor and work expended annually per animal unit.

On farms having well balanced cropping systems and during normal years, a good quality of lespedeza or cowpea hay and some oats could very profitably be substituted for a part of the concentrate feeds which were purchased.

Table 10 LESPEDEZA HAY—MAN LABOR PER ACRE
Arrayed on Cost per Ton

Farm Number	Acres Grown Number	Land Preparation Hours	Sowing Hours	Topping Hours	Cutting Hours	Raking Hours	Hauling Hours	Total Labor Hours	Yield per Acre Tons
7	1.5	6.0	(1)	.....	1.3	(2)	2.7	10.0	2.0
6	3.0	.....	(1)	.....	1.7	1.3	2.3	5.3	1.0
17	2.9	.....	(1)	.....	1.0	(2)	2.1	3.1	.7
11	5.9	.....	(1)	.8	2.0	1.0	.8	4.6	1.0
12	6.0	.....	(1)	.8	1.7	.8	.8	4.1	.5
4	3.0	.....	(1)	.....	.7	1.0	7.3	9.0	1.0
13	1.0	2.0	(1)	.....	2.0	(2)	5.0	9.0	1.0
8	8.0	.....	(1)	.6	2.9	1.6	5.0	10.1	1.0
19	1.6	17.5	(1)	.....	3.1	(2)	1.2	21.9	1.9
2 & 3	1.2	11.2	4.0	.....	2.4	(2)	2.4	20.0	.4
5	2.3	4.3	3.1	.....	.9	1.3	1.7	11.3	.2
Wt. Av.	3.3	1.7	.3	.4	1.9	.9	2.8	8.0	.9
			Horse Work per Acre						
7	1.5	7.3	(1)	.....	2.6	(2)	5.4	15.3	2.0
6	3.0	.....	(1)	.....	3.3	2.7	4.7	10.7	1.0
17	2.9	.....	(1)	.....	2.1	(2)	4.1	6.2	.7
11	5.9	.....	(1)	1.6	3.7	1.0	1.1	7.4	1.0
12	6.0	.....	(1)	.8	3.4	1.6	1.6	7.1	.5
4	3.0	.....	(1)	.....	1.3	2.0	9.3	12.6	1.0
13	1.0	.....	(1)	.....	4.0	(2)	10.0	14.0	1.0
8	8.0	.....	(1)	1.2	5.8	3.2	6.4	16.6	1.0
19	1.6	30.0	(1)	.....	6.2	(2)	2.5	38.7	1.9
2 & 3	1.2	12.8	.....	.....	4.8	(2)	4.8	22.4	.4
5	2.3	12.2	5.2	.....	1.8	2.6	3.4	25.2	.2
Wt. Av.	3.3	2.8	.3	.7	3.7	1.7	4.3	13.5	.9

(1) Seeded from previous year's crop.
(2) Included in cutting.

Table 11 SORGHUM FOR SYRUP—COST PER ACRE AND PER UNIT
Arrayed on Cost per Gallon Syrup
4 Crops—Choctaw County—1925

Farm Number	Man Labor Dollars	Horse Work Dollars	Other Costs Dollars	Total Cost per Acre Dollars	Seed Credit Dollars	Net Cost per Acre (1) Dollars	Yield per Acre Gallons	Acres Grown Number	Cost per Gallon Cents
4	23.19	23.13	4.23	50.55	42.00	8.55	136.4	.77	.06
14	14.06	9.37	1.83	25.26	.....	25.26	112.5	.80	.22
2 & 3	10.41	6.27	2.66	20.34	6.00	14.34	43.5	1.70	.33
9	45.41	42.31	4.20	91.92	40.00	51.92	91.4	.35	.57
Wt. Av.	17.31	14.02	3.43	34.77	15.59	19.18	83.1	.90	.23

(1) Exclusive of charge for use of land.

Table 12 SORGHUM FOR SYRUP—MAN LABOR PER ACRE
Arrayed on Cost per Gallon

Farm No.	Acres Grown No.	Land Preparation Hrs.	Harrow and Plant Hrs.	Hoe Hrs.	Cultivate Hrs.	Strip and Cut Hrs.	Haul Hrs.	Make Syrup Hrs.	Thresh Seed Hrs.	Total Labor Hrs.	Yield per Acre: Syrup Gals.	Yield per Acre: Seed Bu.
4	.77	.....	15.6	10.4	9.1	31.2	23.4	57.1	7.8	154.6	136.4	28.
14	.80	8.7	10.7	5.0	3.1	46.2	7.5	12.5	.....	93.7	112.5	.....
2 & 3	1.70	5.3	1.8	2.3	1.2	21.1	15.9	15.3	3.5	69.4	43.5	4.
9	.35	43.0	14.1	25.7	.....	77.1	34.3	102.8	5.7	302.7	91.4	20.
Wt. Av.	.90	9.0	7.4	6.9	3.2	34.3	21.8	30.4	3.9	116.9	83.1	9.8
Horse Work per Acre												
4	.77	.....	19.5	.....	9.1	.....	36.4	98.1	15.6	179.3	136.4	28.
14	.80	7.4	26.3	.....	3.1	.....	10.0	12.5	.....	59.3	112.5	.....
2 & 3	1.70	5.3	1.8	.....	1.2	.....	20.0	15.3	7.0	50.6	43.5	4.
9	.35	42.8	.....	.....	3.1	.....	22.8	102.8	5.7	174.1	91.4	20.
Wt. Av.	.90	8.3	10.8	.....	3.2	.....	23.2	39.2	7.2	91.9	83.1	9.8

Table 13 WORKSTOCK—ANNUAL COST OF MAINTENANCE PER ANIMAL UNIT
Arrayed on Cost per Hour of Horse Work
19 Farms—Choctaw County—1925

Farm Number	Animal Units Number	Value of Feed Dollars	Value of Pasture Dollars	Depreciation Dollars	Other Costs(1) Dollars	Gross Cost Dollars	Appreciation Dollars	Net Cost Dollars	Hours Worked Number	Cost per Hour of Work Cents
7	2.87	73.25	2.72	.....	15.54	91.51	8.71	82.80	903	9.2
18	3.00	51.53	1.83	.....	27.58	80.94	8.33	72.61	748	9.7
12	3.08	103.89	2.37	.....	23.28	129.54	30.84	98.70	983	10.0
15	2.00	85.02	4.03	.....	13.88	102.93	12.50	90.43	829	10.9
6	2.00	68.12	2.50	7.50	16.02	94.14	.....	94.14	868	11.0
16	4.10	39.66	1.37	7.32	12.16	60.51	.....	60.51	508	11.9
3	2.14	85.05	1.51	.....	16.16	102.72	4.67	98.05	820	12.0
2	2.00	81.76	1.51	.....	15.05	98.32	25.00	73.32	581	12.7
4	3.00	75.12	1.88	1.67	16.13	94.80	.....	94.80	733	12.9
8	8.00	83.71	2.38	.....	15.24	101.33	7.50	93.83	718	13.0
1	2.00	61.17	2.84	.....	14.95	78.96	18.75	60.21	442	13.6
14	3.40	79.44	1.44	2.94	21.78	105.60	.....	105.60	669	15.8
13	1.80	84.44	3.44	.....	16.67	104.55	19.42	85.13	506	16.8
19	4.00	81.81	2.91	5.00	13.41	103.13	.....	103.13	615	16.8
17	4.00	94.09	2.24	1.25	13.10	110.68	.....	110.68	638	17.3
10	2.07	92.00	3.06	1.21	17.29	113.56	.....	113.56	642	17.6
5	1.99	79.09	2.85	.....	14.70	96.64	1.26	95.38	530	18.0
9	3.00	91.51	2.52	11.67	16.09	121.79	.....	121.79	500	24.3
11	2.09	111.68	2.53	.....	15.64	129.85	4.30	125.55	500	25.1
Wt. Av.	2.98	79.37	2.34	2.17	16.45	100.33	6.61	93.72	676	13.9

(1) Man labor, taxes, and interest on investment.

Note: It is assumed that the value of manure will offset the building and equipment charge.

Tables 15 and 16 deal with the poultry enterprise. The average number of hens kept per farm in the group under study is considerably above the average for the state. Of the 19 farms, all showed a profit per hen on the basis of subtracting costs from the sum of egg values and poultry sales. Eggs were produced at a profit in most cases, even when poultry sales were left entirely out of the account. But, even with the good showing made on most of the farms, there is much room for improvement in the conduct of the poultry enterprise. An average of 2.9 dozen eggs annually per hen is entirely too low. Careful selection of the flock with early hatching and rigid culling would easily double or triple the average egg production without reducing the volume of poultry sales.

On the contrary, poultry sales would probably increase due to the culling process. In addition a more valuable product could be produced by confining the roosters after the hatching season and by carefully grading the eggs.

The farmers of the community are giving more attention to poultry than was formerly done, and it is probable that this enterprise will become more profitable as time goes on.

Hogs are kept in the community primarily for family use. Table 17 shows the quantity expenditures, with values, per cwt. of pork produced. Such animals as were sold on foot were weanling pigs sold to neighbors for butcher hogs. A small amount of dressed pork was sold in the community. The amount of dressed pork produced per farm ranged from 233 to

Table 14 WORKSTOCK—ANNUAL QUANTITY COSTS PER ANIMAL UNIT
Arrayed on Cost per Hour of Horse Work
19 Farms—Choctaw County—1925

Farm Number	Animal Units Number	Corn(1) Pounds	Oats Pounds	Mill Feed Pounds	Hay Tons	Corn Fodder(2) Tons	Pasture Days	Man Labor Hours
7	2.87	4061	.....	.....	.78	.....	136	54.7
18	3.00	3009	.....	.....	.27	.....	91	74.9
12	3.08	5807	.....	32	.90	.....	116	88.5
15	2.00	3672	19	.....	.50	.26	202	45.0
6	2.00	3600	.....	.....	.75	.....	125	65.8
16	4.10	2546	.....	.....	.....	.....	68	43.2
3	2.14	3041	15	.....	.70	.....	76	53.2
2	2.00	2821	16	150	1.25	.02	75	51.9
4	3.00	2205	.....	303	1.27	.....	91	57.9
8	8.00	4140	.....	.....	1.25	.....	118	35.5
1	2.00	3685	.....	.....	1.38	.....	142	59.0
14	3.40	4108	141	.....	.63	.27	72	64.4
13	1.80	3830	.....	.....	1.53	.08	172	63.0
19	4.00	3974	12	125	.72	.....	145	51.4
17	4.00	4536	.....	.....	1.55	.....	112	47.0
10	2.07	4365	386	482	.....	.20	153	72.9
5	1.99	3256	.....	625	.73	.11	143	67.8
9	3.00	4200	.....	.....	1.60	.....	126	55.6
11	2.09	5466	.....	.....	1.88	.....	126	62.5
Wt. Av.	2.98	3825	25	76	.98	.04	117	55.8

(1) In ear, unhusked—72 lbs. to 1 bu.
(2) Blades stripped from stalk.

1116 pounds and averaged 650 pounds. In several cases, the pork was made almost entirely on kitchen and garden refuse and weeds carried to the hogs by children. A few farms had hog pastures and a few pastured small fields after the crops were gathered, neither of which are accounted for in the table. An improvement which could be made in the hog enterprise is the substituting of pastures, both natural and planted, for mill feeds shown in the table, all of which were purchased.

Table 15 DAIRY CATTLE—ANNUAL COST OF MAINTENANCE PER ANIMAL UNIT AND COST PER POUND OF BUTTER FAT

Arrayed on Cost of Producing Butter Fat

19 Farms—Choctaw County—1925

Farm Number	Animal Units Number	Value of Feed Dollars	Value of Pasture Dollars	Depreciation (1) Dollars	Value of Man Labor Dollars	Other Costs (2) Dollars	Total Costs (3) Dollars	Butter Fat Produced Pounds	Cost per lb. Fat Cents
15	2.00	24.32	4.88	2.70	6.44	1.94	40.28	246.6	.16
12	4.30	30.76	5.23	2.97	12.11	2.40	53.47	233.5	.23
18	3.00	14.81	4.88	2.55	14.20	1.62	38.06	151.7	.25
1	1.00	24.45	4.88	3.60	19.65	2.40	54.98	200.0	.28
8	14.30	25.59	4.24	4.05	9.10	3.51	46.49	142.7	.33
7	2.20	17.70	4.80	3.48	13.40	2.66	42.04	114.1	.37
16	4.30	5.30	4.26	2.40	9.17	1.53	22.66	61.5	.37
13	1.85	29.81	4.62	3.60	12.53	2.29	52.85	136.0	.39
10	3.52	17.54	5.20	3.00	12.40	2.91	41.05	79.3	.52
2	2.36	41.04	4.66	3.00	9.88	2.02	60.00	116.0	.52
11	4.83	37.95	5.06	2.60	9.25	1.87	56.71	107.3	.53
14	1.20	11.50	2.88	3.60	14.38	2.29	34.65	65.3	.53
3	2.00	42.57	4.28	3.60	11.50	2.65	64.60	116.7	.55
19	4.50	12.49	4.35	3.13	7.86	2.01	29.84	48.2	.62
4	1.76	47.69	7.50	3.00	10.16	1.91	70.26	96.3	.73
6	3.27	34.91	5.60	3.00	12.98	2.45	58.94	73.7	.80
9	2.60	30.38	4.22	3.60	11.42	4.05	53.97	68.5	.84
5	2.00	51.88	4.62	4.20	13.42	2.68	76.80	88.7	.87
17	4.00	28.09	4.88	2.40	8.62	1.53	45.52	52.0	.88
Wt. Av.	3.42	26.36	4.71	3.24	10.74	2.51	47.56	115.8	.41

(1) Calculated at 12 per cent.

(2) Horse work at cost, interest at 6 per cent, and taxes at 2 per cent.

(3) Assumed that manure and skim milk credits are equivalent to building and equipment charges.

Table 16 DAIRY CATTLE—ANNUAL QUANTITY COSTS PER ANIMAL UNIT
Arrayed on Cost of Producing Butterfat
19 Farms—Choctaw County—1925

Farm Number	Animal Units Number	Cotton Seed Meal Pounds	Corn Pounds	Cotton Seed Pounds	Other Concentrates Pounds	Hay Tons	Cotton Seed Hulls Tons	Pasture Days	Man Labor Hours	Horse Work Hours
15	2.00	550	.....	.....	160	.15	.35	244	42.9	2.0
12	4.30	93	450	703	.....	.58	.12	262	81.3	5.1
18	3.00	333	.....	316	.....	.10	.....	244	94.7	.....
1	1.00	400	.....	312	.....	.05	.30	244	131.0	.....
8	14.30	889	.....	.....	.....	.14	.49	212	60.3	7.2
7	2.20	318	.....	400	.....	.80	.....	240	89.3	4.6
16	4.30	163	.....	233	.....	.....	.....	213	61.2	.....
13	1.85	243	.....	269	.....	1.08	.22	231	83.5	.....
10	3.52	369	.....	.....	.....	.....	.66	260	82.7	5.7
2	2.36	614	.....	366	.....	.55	.58	233	65.9	.8
11	4.83	83	812	49	.....	1.25	.08	253	61.7	.8
14	1.20	167	.....	155	.....	.26	.....	144	96.0	.....
3	2.00	375	.....	800	.....	1.00	.41	214	76.8	3.0
19	4.50	117	.....	584	.....	.....	.08	217	52.4	.....
4	1.76	227	1273	795	.....	.40	.06	365	67.8	.....
6	3.27	367	264	475	.....	.76	.52	280	86.5	4.9
9	2.60	.....	.....	535	151	1.15	.....	211	76.2	8.5
5	2.00	.....	540	928	.....	.62	.....	231	89.5	.....
17	4.00	75	900	736	.....	.02	.....	244	58.5	.....
Wt. Av.	3.42	369	210	327	11	.42	.24	234	70.6	3.2

Table 17 POULTRY—ANNUAL COST PER HEN, COST PER DOZEN EGGS (1) AND NET PROFIT PER HEN (2)
Arrayed on Net Profit per Hen
19 Farms—Choctaw County—1925

Farm Number	Hens Kept Number	Value of Feed Cents	Value of Labor Cents	Cost per Hen Cents	Eggs Produced Dozens	Cost per Dozen Cents	Meat Produced Pounds	Value of Meat Dollars	Profit per Hen Dollars
4	55	28.4	9.2	37.6	3.51	10.7	6.9	1.51	2.02
1	50	52.6	18.6	71.2	6.06	11.7	3.8	.77	1.57
5	35	38.6	27.0	65.6	4.37	15.0	3.7	.82	1.25
6	50	61.3	20.1	81.4	3.00	27.2	5.4	1.19	1.13
2	36	52.1	32.8	84.9	3.89	21.8	4.3	.95	1.07
11	74	40.1	12.6	52.7	4.92	10.7	1.7	.37	1.07
13	43	59.4	19.5	78.9	3.63	21.8	4.0	.88	1.00
15	77	15.0	12.0	27.0	1.70	16.0	3.4	.75	.90
14	43	50.6	22.4	73.0	3.85	18.9	2.8	.61	.85
3	43	54.6	18.6	73.2	1.13	64.9	5.4	1.20	.75
16	76	16.4	13.0	29.4	2.16	13.7	2.1	.46	.71
9	56	48.0	17.1	65.1	2.00	32.5	3.4	.76	.60
10	53	2.6	16.6	19.2	1.61	11.9	1.7	.37	.58
12	94	51.3	13.9	65.2	3.87	16.8	1.2	.26	.57
19	63	31.2	14.5	45.7	3.35	13.6	.7	.14	.52
8	112	55.0	9.8	64.8	2.23	29.1	2.8	.57	.47
17	62	31.4	17.2	48.6	2.14	22.7	1.6	.36	.40
7	74	65.4	10.5	75.9	2.10	36.0	2.7	.58	.35
18	81	37.5	20.7	58.2	1.62	35.8	1.6	.35	.02
Wt. Av.	62	41.2	15.9	57.1	2.90	19.7	2.9	.61	.76

(1) Annual cost per hen divided by eggs produced. Should the value of meat produced be credited, some farms would produce eggs at a minus cost.

(2) Eggs valued at 25 cents per dozen.

Table 18 POULTRY—ANNUAL QUANTITY EXPENDITURES PER HEN
Arrayed on Net Profit per Hen
19 Farms—Choctaw County—1925

Farm Number	Hens Kept Number	Sorghum and Corn Pounds	Mill Feed Pounds	Total Grain Pounds	Milk Gallons	Man Labor Hours
4	55	13.2	.....	13.2	.....	.60
1	50	11.5	10.5	22.0	.....	1.24
5	35	24.7	.....	24.7	.....	1.80
6	50	33.0	2.4	35.4	.....	1.34
2	36	21.0	5.1	26.1	.....	2.19
11	74	16.6	1.8	18.4	.....	.80
13	43	35.2	.....	35.2	.....	1.30
15	77	6.6	1.3	7.9	.....	.80
14	43	24.1	.....	24.1	.....	1.49
3	43	24.0	.....	24.0	.....	1.24
16	76	10.4	.....	10.4	.....	.87
9	56	23.0	.....	23.0	.....	1.10
10	53	.....	.8	.8	.....	1.11
12	94	22.9	.....	22.9	.33	.92
19	63	12.4	1.6	14.0	.....	.97
8	112	32.1	1.3	33.4	.....	.66
17	62	15.4	.....	15.4	.....	1.10
7	74	25.0	.....	25.0	.....	.70
18	81	16.0	.....	16.0	1.50	1.38
Wt. Av.	62	19.2	1.1	20.3	.10	1.06

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REPORT
SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION 1926

By
E. B. FERRIS and W. S. ANDERSON

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

A Report of Work at South Mississippi Branch Experiment Station for 1926

INTRODUCTION

It was stated in the last annual report that 1925 would likely go down in history as the best year for cotton Mississippi has seen in a quarter of a century. Insofar as the production of cotton and corn at this station is concerned, the seasons were much better in 1925 than in 1926, but for many other farm crops, such as oats, lespedeza, sweet potatoes, and fruit crops generally, 1926 was even better than 1925.

Table No. 1 gives outstanding facts about the weather conditions for these two years. They may easily be compared and a reason shown why one crop has done better in 1925 than in 1926, while other crops have done worse.

TABLE No. 1—COMPARISON OF WEATHER CONDITIONS IN 1925 AND 1926

Month	Year	Max.	Min.	No. days 100 and over	No. rainy days	Total rainfall	Mean max. temp.	Mean min. temp.
March	1925	85	28	0	4	1.30	75.6	51.4
March	1926	76	26	0	14	11.85	66.1	46.4
April	1925	93	50	0	3	1.18	83.3	59.5
April	1926	84	37	0	11	4.92	75.9	52.8
May	1925	94	44	0	6	3.26	85.5	61.0
May	1926	94	50	0	8	3.23	84.4	61.5
June	1925	98	66	0	12	5.89	91.8	70.9
June	1926	95	57	0	8	3.95	90.0	68.6
July	1925	97	68	0	13	4.37	91.7	72.2
July	1926	96	64	0	9	5.62	92.0	70.3
August	1925	103	64	3	15	1.52	93.5	71.6
August	1926	97	69	0	9	8.98	90.7	72.7
September	1925			5	9	4.26		
September	1926	96	62	0	8	5.78	90.7	70.2
October	1925	84	40	0	13	7.39	80.0	63.6
October	1926	92	39	0	4	3.86	83.7	61.0
November	1925	82		0	6	1.91	69.6	
November	1926	80	28	0	6	1.99	67.0	43.8

COTTON AND CORN

Circulars on both cotton and corn were issued in 1925. At that time sufficiently important results with corn had been obtained to justify such a publication. In 1926 drouth struck corn at the wrong time and results were so poor that a separate circular is not justified, and in this report

only such results with corn are given as seem worth publishing. A separate circular is being issued this year on cotton, because cooperative tests in four other counties make such a circular worth while.

Work with corn in 1926 included testing of twenty standard varieties which were planted early in April. Good stands were obtained. However, bud worms destroyed these stands to such an extent that all these varieties had to be planted over. The second planting of this corn was also considerably injured by bud worms and in order to secure results, a good deal of trans-planting had to be done. This trans-planted corn did not do well and the results are consequently impaired to this extent. Table No. 2 gives the results of this test with varieties and is self-explanatory.

TABLE No. 2—CORN VARIETY TEST, 1926

Variety	Bushels per acre		
	Total yield	Sound corn	Per cent. of grain
Mosby, Station	39.3	26.7	76.8
Mosby, Delta	39.5	24.6	78.5
Mosby, Lee	33.5	9.1	83.9
Mosby, Suttle	31.5	23.5	80.3
Cocke's Prol., Sta.	41.6	21.4	76.8
Cocke's Prol., Delta	34.6	20.3	76.8
Hasting's Prol.	37.3	21.4	83.9
Johnson's Prol.	34.2	23.0	78.5
Delta Prol.	39.5	24.1	76.8
Mexican June	39.5	29.4	76.8
Laguna	36.4	21.9	76.8
Ellis	27.8	19.2	73.2
Paymaster, Neal	42.5	16.6	76.8
Paymaster, Fisher	44.7	23.0	78.5
Yellow Dent, Ferg.	36.1	16.6	78.5
Yellow Dent, Station	41.5	18.7	76.8
Golden Dent, Ul.	38.4	16.6	82.1
Golden Dent, Sta.	32.2	15.6	73.2
Brunson, Prol.	27.1	17.6	76.8
Johnson's Prol. (Home)	27.8	23.0	78.5

In addition to work with varieties, the same work with fertilizers reported last year was carried on this year, but on account of drouth the yields were so low that the fertilizers did not pay and this work gives very little indication of what might have been expected under average seasons. The results are given in Table No. 3.

In addition to the regular work with fertilizers, we also tested factory mixed fertilizers of three different compositions, comparing them with home mixed fertilizers furnishing the same amount of plant food. This was done in a new field heretofore used for pasture, which was converted into fertilizer test plats after the selling of the dairy cattle. This work was done on nine one-twentieth acre plats repeated three times, with checks at the beginning, at the end, and in the center of each series with three fertilized plats between the checks. This particular corn was the best made on the place, possibly due to the fact that the land had more vegetable matter and withstood the drouth better than any other corn grown.

TABLE No. 3—CORN FERTILIZER TEST, 1926

Pounds of material applied per acre				Pounds husked corn per acre		Dollars per acre			
Acid phos.	Nit. of soda	Sul. of potash	Formula	Plot yield	Check yield	Increase	Increase at 1½c	Cost of fert.	Net gain
No fertilizer				780	780				
300	150	100	8-4-8	990	755	235	3.53	9.81	-6.28
300	150	75	8-4-6	970	730	240	3.60	9.14	-5.54
300	150	50	8-4-4	950	705	245	3.68	8.47	-4.79
No fertilizer				680	680				
300	150	25	8-4-2	1043	653	390	5.85	7.80	-1.95
300	150	—	8-4-0	990	625	365	5.48	7.13	-1.65
300	300	50	8-8-4	1140	598	542	8.13	12.89	-4.76
No fertilizer				570	570				
300	225	50	8-6-4	1160	568	592	8.88	10.68	-1.80
225	150	50	8-4-4	1060	565	495	7.43	7.80	- .37
150	150	50	4-4-4	960	563	397	5.96	7.12	-1.16
No fertilizer				560	560				
600	300	100	8-4-4	1090	600	490	7.35	16.93	-9.58
900	450	150	8-4-4	1000	640	360	5.40	25.40	-20.00
1200	600	200	8-4-4	980	680	300	4.50	33.86	-29.36
No fertilizer				720	720				

NOTE—The materials applied to the last three fertilized plats supply approximately as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively, of an 8-4-4 mixed fertilizer. All other treatments were based on 600 pounds of mixed fertilizer of the formulas indicated.

The average yield of all check plats in this test was at the rate of 2337 pounds of husked ears to the acre. The addition of 600 pounds of an 8-4-4 fertilizer, factory mixed, increased this yield 400 pounds; the same amount of plant food furnished by acid phosphate, nitrate of soda, and sulphate of potash gave an increase of 380 pounds; 600 pounds of an 8-5-4 factory mixed increased the yield of corn 230 pounds, while a home mixed fertilizer, furnishing the same amount of plant food, increased the yield 250 pounds; 600 pounds of a 10-5-3 fertilizer, factory mixed, increased the yield 410 pounds, while the same amount of plant food mixed here increased the yield 390 pounds. None of these increases were sufficient to pay the cost of the fertilizer used.

WORK WITH OATS

In the fall of 1925, cotton stalks were destroyed when picking was completed and oats planted as a winter cover crop, the intention being to turn under these oats in the spring when preparing the land for other crops. However, taking in the forty acre field heretofore used as pasture gave more land than was needed for immediate planting and a great many of these oats were left to mature. On a field of about six acres, tests were conducted to show the results of different dates for applying nitrate of soda, the use of varying amounts of nitrate of soda, and the comparative yields from the same amounts of nitrogen furnished by nitrate of soda, sulphate of ammonia, and calcium cyanamid.

All this work, except that with calcium cyanamid, was done on one-sixth acre plats, beginning and ending with checks, with check plats distributed every fourth plat throughout the field. A circular was issued early in the year giving these results, which showed the following increases due to the fertilizers: 100 pounds nitrate of soda, 1390 pounds of oats in bundle; 200 pounds nitrate of soda, 1830 pounds; 300 pounds nitrate of soda, 2730 pounds. Two hundred pounds of nitrate of soda applied February 15, 2468 pounds of oats; 200 pounds, March 1, 2138 pounds; 200 pounds March 15, 1776 pounds. Two hundred pounds of nitrate of soda, 1830 pounds oats; 150 pounds sulphate of ammonia, 1542 pounds oats; 138 pounds calcium cyanamid, 1846 pounds oats.

This calcium cyanamid was not used in such a way as to be accurately compared with the other two sources, as it was not on hand when the experiment was started and in order to use it, it had to be applied at a slightly later date on land in the same field and of about the same quality. The yield on the cyanamid plat was compared with the average yield of twelve check plats in the regular tests, this cyanamid plat having been placed adjacent to the ends of all the plats referred to.

It was hoped later to thresh each plat of oats separately and obtain the percentage of grain to straw, but it was found impossible to find separate storage space for these oats, as it was equally impossible to thresh them as they were harvested, so we can give only the percentage of grain to straw as it was determined later for a single weighing. This was 43% of the weight of the oats when threshed and it is estimated that if 40% of the increase as given is taken, an approximate idea of the increase in grain will be arrived at. The average yield of twelve check plats was at the rate of 3306 pounds of oats in bundle per acre.

COOPERATIVE WORK

Cooperative work with fertilizers under cotton was conducted in four counties, namely: Pike, Forrest, Lamar, and Harrison. This was done in every instance with the County Agent of these counties on farms where the owners were capabe of keeping records and had land that was suited to the work. Press circulars have been issued giving results of all this work and these results will also be given in our regular circular on cotton.

It might be well here to mention the possibilities for good that may come out of this cooperative work. In Pike County the work was done on the farm of Mr. G. H. Alford, adjacent to the Progress Consolidated School. This is the largest consolidated school in Pike County and after the work was started Mr. Alford and County Agent Flowers arranged for an important three days meeting of the farmers of that county at this school. They asked that the plats in this test be labeled, showing the fertilizers used, and that a representative of the station be at this meeting to explain the work and give a talk on fertilizers for Pike County. Printed stakes were taken to each of these cooperative tests so that the people who visited them might see the effects of these different fertilizers on cotton. A station representative spent a day at Progress School where the leading farmers of the county were met and shown the effects of the fertilizers in question, and later a talk was made before the assembled crowd on fertilizers in general. This is mentioned as being one of the best ways for making this coopera-

tive work of general use to the farmer, especially to those who do not visit the Station at Poplarville.

VISITORS TO THE STATION

During the year most of the county agents in South Mississippi have visited this station, bringing with them such farmers and business men as could leave their work and were interested in the experiments conducted. In this way, a great many people visited the station during the year. In addition to these, many Smith-Hughes men, teaching agriculture in the various consolidated schools of South Mississippi, visited here during the year, bringing with them the students who were studying agriculture in these schools. Also, during the year, Mr. D. L. Williams, supervisor of such work, brought all the teachers in Smith-Hughes work here to inspect the station and to listen to explanations about our work by station employees. These teachers spent the night at Poplarville, using the dormitories of the local A. H. S. and Junior College for sleeping quarters.

Two other important meetings, one of scientists held by Dr. G. N. Hoffer of Purdue University, and the other of fertilizer salesmen, were held during this year.

COOPERATIVE WORK WITH STATE PLANT BOARD

Work has been conducted here in 1926, in cooperation with the State Plant Board, in the growing of sweet potato plants for the weevil infested areas of South Mississippi. Mr. J. E. Lee is the present Plant Board representative and grew this year, on land furnished by the station, all the sweet potato plants needed for infested properties in the weevil district.

While provision was made for poisoning cotton on the station against the boll weevil, Mr. Lee never found it advisable in 1926 to do any poisoning, the weevil having reached dangerous proportions at a date too late to justify poisoning.

JAVA SUGAR CANE

Early in 1925 Mr. D. C. Neal, Plant Pathologist at the A. & M. College, sent this station sufficient seed of Cayana No. 10 sugar cane to plant one-sixth acre. He also had sent from Cairo, Georgia, four varieties of P. O. J. sugar cane sufficient to plant very small areas. This Cayana No. 10 sugar cane made fine yields in 1925 and the cane was distributed to various growers over South Mississippi. The P. O. J. varieties were not distributed at all in 1925, but were planted here to increase the supply for 1926. Several press circulars have been issued calling attention of the people to this work and agreeing to furnish them small quantities of this cane free of charge to enable them to get a start. While a number requested the cane for planting in 1925, the demand was nothing like so great as it has been for the present year's supply. This fall growers have come here in trucks from Magnolia and McComb, on the west, to Biloxi on the east, and Hattiesburg on the North, seeking to get this cane for future planting, so that the entire supply, exceeding that of 1925, has been taken for planting purposes.

WINTER COVER CROPS

This station has been trying to find a winter cover crop for South Mississippi that could be unqualifiedly recommended for general growth. It has tested vetch and burr clover, possibly the best of these, repeatedly, and has not found that they could always be depended upon. This year it is trying out a new crop of the kind in Austrian Winter Peas and has planted some eight acres of them in various ways: Alone in drills; alone broadcast; broadcast with oats; and broadcast on bermuda and carpet grass sod for pasturage. These peas have proven quite valuable on similar soils to ones here in other parts of the South, especially at the Coastal Plains Experiment Station, Tifton, Georgia.

Vetch has proven so valuable a winter cover crop in other parts of Mississippi that this station has determined to do further work with this crop and as a means to this end has planted about eight acres this fall as follows: Alone in drills, alone broadcast, in combination with oats, and as a pasture crop on bermuda and carpet grass sod.

Burr clover has possibly been the most reliable winter leguminous cover crop here in the past, although this has been badly injured by disease. Work with standard varieties of burr clover has been continued in the fall of 1926 and in addition to these, a new kind especially adapted to Coastal Plain conditions, as found out by the Coastal Plain Experiment Station at Tifton, Georgia, has been added. A few seed of this burr clover was furnished the station this fall by the above station and has been planted here with the hope that it will withstand diseases that have heretofore rendered ordinary burr clover unreliable.

LESPEDEZA

About seven acres of land planted to oats in the fall of 1925 were sown to lespedeza in February of 1926. This came up to a good stand and when the oats were harvested, continued to develop during the summer and fall. Two other acres of land in the field heretofore used as pasture for cattle were left to lespedeza. All this, under fairly favorable seasons, developed into good hay and was cut in the fall after the seed were matured. This hay was saved in good condition and was later baled, giving approximately an average of one ton of baled hay per acre.

ROTATION EXPERIMENTS

Reference has been made to work with rotations, or cropping systems, in all reports for the past six years. This work was continued in 1926 and a press circular has been recently issued calling attention to the fact that where cotton followed cotton during all these years, diseases, principally wilt, had come in to such an extent as to destroy a very large percentage of the stand. No very positive conclusions have been drawn from this work other than that it will surely be suicidal here to grow cotton year after year on the same land. This work will be continued in the future with the hope of being able to report progress towards showing the benefits of rotation.

SOIL FERTILITY TESTS

This work, too, has been mentioned in several previous reports. Last year the outstanding feature of it was the large yield of six-weeks cowpeas obtained on plats devoted to this crop and the great injury to corn by planting velvet beans in drill with it at the same time as the corn. In 1926 these plats came back to cotton as a measure for finding the effects of the three legumes grown alone and in combination with corn as compared with corn alone. A press circular has been issued this year showing that cotton following these several crops, or combination of crops, gave an average yield on the four tests as follows: After peas alone, 1205 pounds of seed cotton; after soybeans alone, 1125 pounds; after velvet beans alone, 1170 pounds; after corn and peas, 1190 pounds; after corn and soybeans, 1185 pounds; after corn and velvet beans, 1195 pounds, and after corn alone, 1015 pounds.

This work was undertaken primarily to find out the comparative value of these soil builders, as well as to see if the popular impression, recently current that velvet beans injured the land on which they were grown was correct. These tests indicate that this is not true and confirm the explanation heretofore given that the indiscriminate grazing of these beans throughout the winter has probably been the cause of land injury, rather than the growing of beans themselves.

WORK WITH TOBACCO

The growing of bright leaf tobacco appears to have great possibilities for South Mississippi. On similar lands to the east of us in Alabama, and especially in Georgia, the farmers are going heavily into the production of this tobacco and apparently are making it very profitable. For several years this station has considered growing tobacco experimentally, but had no one on the place who knew anything about growing and curing tobacco and funds were not sufficient to employ such a man.

About a year ago a representative of the Southern Railroad agreed if this station would grow and provide the means of curing a few acres of tobacco, the Southern Railroad would furnish an expert to supervise growing and curing. The work was undertaken with this agreement and early in January seed furnished by the Southern Railroad were planted, good stands obtained, and the plants put into the field from the 7th to the 22nd of April. These plants should have been set in the field the last days of March. They were placed on level land which had been divided into a large number of small plats so that the best source of potash for tobacco might be tried, at the same time the ability of these soils to grow first class tobacco was determined. When this tobacco was ripe, Mr. R. O. Lawhon was sent here to supervise the curing. He pronounced it then a good yield of first quality tobacco with the single exception of having been injured early in its growth by bud worms.

A curing house 16x16x16 was built, flues installed, and the curing started at the proper time. After the first picking had been cured and the fires from the furnace had been drawn twenty-four hours, the house and its content of tobacco went up in flames originating from an unknown cause. A new house was built immediately, but this threw us ten days late in

curing the remainder of the tobacco. This injured the grade considerably and caused the loss of fully one-fourth of the tobacco grown, besides a good deal that had become too ripe to be worth curing. After curing such as was worth harvesting, the product was shipped to a warehouse in South Georgia and sold. From practically two acres 1186 pounds were sold for an average price around fifteen cents, which was fully ten cents below the market for average tobacco at that date.

It is estimated that this tobacco made at the rate of 1000 pounds to the acre and while no conclusions could be drawn about the best form of potash, the yields would indicate that potash was essential in a fertilizer for tobacco.

The final conclusion from this year's work with tobacco is that bright leaf tobacco is a crop well suited to the soil and climatic conditions of this section and that in the hands of careful growers it will prove a valuable money crop. While the curing of this tobacco requires a good deal of time and careful handling, it will, perhaps, pay a greater premium on work well done than any other standard farm crop and can be grown along with cotton, not seriously interfering with this cotton. A large part of the work of getting the crop into the field comes before cotton is planted, no excessive amount of cultivation is required, and the curing and marketing of the the tobacco should come after the rush of hoeing and cultivating the cotton is over.

The station intends to continue the work with tobacco on a small scale until several years results have been accumulated.

Report of Horticultural Work at the South Mississippi Experiment Station for 1926

The investigation in horticulture as reported in Bulletin No. 232 from this station have been continued with some additions during 1926. The projects may be grouped as follows:

1. Plant Breeding and Selections for Varietal Improvement.
2. Fertilizer Tests.
3. Variety Tests.
4. Cultural Tests.
5. Cooperative Tests.
6. Dusting and Spraying Tests.

PLANT BREEDING AND SELECTION FOR VARIETAL IMPROVEMENT

Sweet Potatoes—The work with selection of Nancy Hall sweet potatoes for improvement of the variety has been continued again this year with results more indicative of benefit than those of last year. As reported in Circular No. 57, the "H. Y.", or high yielding strain, made an increase of 19% in production the first year after selection over the "L. Y.", or low yielding strain; 15% the second year; 23% the third year; and last year the "L. Y." strain made an increase of 14.6% over the "H. Y." In 1926 the "H. Y." strain made a total of 2576 pounds, while the "L. Y." strain made only 2236 pounds, which is an increase of 15.2% in production in favor of the "H. Y." strain. This selection work will be continued another year with renewed interest.

Porto Rico sweet potatoes were planted in alternate plats with the two strains of Nancy Halls and a production of 2429 pounds of Porto Ricos was secured, which is slightly different from results obtained heretofore. This variety has usually been decidedly in the lead in production of marketable roots.

Blueberries—The work which has been under way for three years with the selection of individual plants in a planting of some five hundred specimens of wild blueberry from the woods of Florida, has been continued in 1926. This year the entire planting made very satisfactory growths and produced a fine crop of fruit as a whole. Some plants, of course, produced better crops than others. A close watch was kept of the various selections made in 1925 and others studied while the fruit was ripe. Prof. J. C. C. Price of the Main Station at A. & M. College is cooperating in this blueberry work and this year visited this station while the fruit was ripe and made careful notes of the various types which have been selected for continued study. A few of the types appear to be favorable enough to warrant propagation and the making of additional plantings. Mr. Price will also help in this propagation work and plans to find out the best and most practical method to propagate blueberries. There have so far been found no pests of the blueberry as grown here and it is apparently suited to the soil and climatic conditions, so, apparently, it has a place in horticulture of South Mississippi and in a few years there may be available for distribution propagated material of types which will be suitable, at least, for planting in home orchards.

FERTILIZER TESTS

Tomatoes—The test of fertilizers under tomatoes which was started here in 1925, comparing several formulas and amounts per acre, has been continued on the same plats this year. Norton Wilt Resistant plants were used in setting the field on May 3, the fertilizers having been applied and the land prepared thoroughly on April 27. The table below shows results obtained from this work in 1926. Although these figures cannot be used to make definite recommendations, they are to some extent indicative of the best way to fertilize tomatoes under these conditions.

TABLE 4—TOMATO FERTILIZER RECORD, 1926

Pounds of material applied per acre				Pounds per acre		Dollars per acre		
				No. 1				
Acid phos.	Nit. of soda	Sul. of potash	Formula	Total	Increase	Value	Cost of fert.	Net Gain
600	300	200	8-4-8	2593	2412	108.00	19.61	88.39
600	300	150	8-4-6	2738	2376	114.00	18.27	95.73
600	300	100	8-4-4	4002	3459	166.75	16.93	149.82
600	600	100	8-8-4	5000	4819	208.30	25.78	182.52
600	450	100	8-6-4	5220	5220	217.50	21.35	196.15
450	450	150	6-6-6	3492	3492	165.50	21.34	144.16
675	450	150	9-6-6	5522	5522	230.00	23.36	206.64
900	450	150	12-6-6	3144	3144	131.00	25.39	105.61
1200	600	200	12-6-6	1856	1856	77.33	33.86	43.47

Sweet Potatoes—The experiments started in 1925 with fertilizers under sweet potatoes on land north of town leased for experimental work, has

been continued this year. Plants of the Porto Rico variety were used instead of Nancy Hall, as in 1925. These were set June 5 and the crop harvested November 11. Below a table is given showing results of this year's test, which, like that with tomatoes, is too immature to warrant definite recommendation, but may be of value as they are, to some extent, indicative of how growers should fertilize for sweet potatoes.

TABLE 5—SWEET POTATO FERTILIZER RECORD, 1926

Pounds of material applied per acre						
Acid phos.	Nit. of soda	Sul. of potash	Formula	Yield per acre, lbs.	Increase per acre Pounds	Bushels
300	150	100	8-4-8	9210	3990	66.5
300	150	75	8-4-6	8880	3230	53.8
300	150	50	8-4-4	9660	3580	59.6
300	150	25	8-4-2	8760	2063	34.4
300	150	—	8-4-0	5600	-1265	-21.0
300	300	50	8-8-4	7200	148	2.4
300	225	50	8-6-4	10590	3757	62.6
225	150	50	6-4-4	11700	5294	88.2
150	150	50	4-4-4	9510	3532	58.9
600	300	100	8-4-4	9690	4350	72.5
900	450	150	8-4-4	8040	2910	48.5
1200	600	200	8-4-4	6970	2050	34.1

VARIETY TESTS

Fruits—The best crop of fruit ever produced on the variety orchard was harvested from the main peach varieties this year. Also, good growths were made by all trees in the test. Below is a table which shows a summary of the production of peach varieties for this year.

TALE No. 6—PEACH SUMMARY, 1926

Variety	Average per tree Pounds	Bushels	Ripening date
Early Rose	177.8	2.55	June 15
Early Elberta	239.1	4.78	July 20
Georgia Belle	247.0	4.94	July 13
J. H. Hale	35.0	.70	July 30
Crawford's Late	6.5	.13	July 30
Imperial	20.0	.40	July 30
Waldo	120.0	2.40	July 10
Slappy	112.9	2.25	June 26
Hiley	227.5	4.55	July 1
Elberta	189.0	3.78	July 23
Early Mamie Ross	355.0	7.10	June 30
Mayflower	13.0	.26	June 1
Carmen	25.0	.50	June 25
Estella	75.0	1.50	Sept. 1
Alton	220.0	4.40	June 30
Red Bird Cling	15.0	.30	June 15
June Elberta	30.0	.60	June 7
Greensboro	54.0	1.08	June 10

A study of the above table reveals the fact that, first, there were exceptionally large yields of peaches on certain varieties which have heretofore been apparently favorable; second, that most of the varieties reported

ripened their fruit much later than in 1925; and third, that the main varieties which have been recommended for commercial planting in South Mississippi for some years, are still leaders in most cases in production of fruit.

The group of South China peaches which have been under test and known as Florida varieties, are, in the main, still unfavorable under our conditions. Very few trees of this group produced fruit of usable size and quality.

In studying the many varieties of peaches here, there is apparently a need of varieties which ripen quality fruit, both earlier and later than varieties which are now planted. Therefore, additional varieties are being secured which are supposed to ripen fruit, either very early or very late in the season and should thus supply those which are adapted to this section and will lengthen the ripe fruit season for the home orchard grower. Ten varieties have been added this year.

Heretofore, Elberta trees at this station have not produced any crop to speak of, whereas, this year an average of 3.7 bushels per tree was harvested. The fruit was of excellent quality and of ample size and color. The trees, however, have not made normal growths, continuing their habit of making excess production of sucker wood. They came to the end of the season very weak and dropped their leaves soon after fruit was harvested.

All peaches in the station orchard were given an application of eight pounds per tree of an 8-4-4 factory mixed fertilizer, at the first cultivation, about March 15. Clean cultivation was continued until the fruit was ready to harvest. Then it was stopped until October 15, when a cover crop of oats was lightly disced in.

Plums in the variety test have not made very favorable progress during 1926. As a matter of fact, some varieties which have been apparently favorable and have made fair crops heretofore, produced practically no fruit this year. Munson, the large yellow fruited kind, which has made good crops since its third year, is still in the lead of all varieties, with an average annual production of about two bushels per tree. All of the Japanese varieties were weaker of growth and produced less fruit this year than heretofore. This winter several additional varieties of plums, which have apparently been giving good results in other places in the South are being planted. Plums were given the same cultivation as peaches.

None of the apricot varieties have yet produced fruit.

The two varieties of almond, Sultana and Princess, again set fruit this year, as in 1925, but failed to hold it to maturity. Trees of both varieties made very weak growths.

The number of varieties of apples has been cut down this year by fire blight, several trees dying completely. However, several varieties produced a small crop of fruit this year. Day, Hackworth, Red Astrachan, Delicious, Yates, Red Reese, Kinnard's Choice, and Florence Crab, all produced some fruit. Horse, Rambo, Mother, and Sorsby are among others which are still making vigorous growths and have not blighted.

All varieties of pecans in the test made fine growths this year and a few nuts were produced by Stuart, Success, Schley, Teche, Moneymaker, Wright, Frotscher, and Russell.

Varieties of Japanese persimmons in the test made good growth this year and fine crops of fruit were produced by Tane-Nashi, Zengi, Ormond, and Tamopan. The Tane-Nashi seems to be the only one which never fails to make a crop.

Pineapple (Sand) pear, of which there are five trees planted on the station, has made fine growth but no fruit was harvested this year on account of the blooms being killed by a frost which came while they were open.

The twelve varieties of figs in the test are still making good annual growths but none are producing profitable crops under the system of orchard cultivation as practiced. Few fruits ripened, however, on Brunswick, Brown Turkey, Green Ischia, Celeste, Black Ischia, and Black Mission each year. Observation shows that such varieties as above mentioned are well adapted to this section when planted as a door-yard tree, or under conditions where there is assured plenty of moisture and ample fertility without any disturbance of the soil by cultivation. A few additional varieties of figs are being secured this winter for planting in this test.

Grapes, both bunch and muscadine, continued to make satisfactory growth and good crops of fruit this year, although the latter was not as large as in 1925. Two new varieties, Winchell and Armalaga, were added to the test this year, while Niagara, which died at the end of the fourth year, was replaced. The last named died again this season and will be replanted. Several additional varieties are being secured this winter for testing. Below is a table showing the results obtained from the varieties of bunch and muscadine grapes this year.

TABLE No. 7—BUNCH GRAPE SUMMARY, 1926

Variety	Average—pounds Per vine	Per acre (484 vines)	Ripening date
Ellen Scott	11	5324	July 28
Lenoir	50	24200	Aug. 10
R. W. Munson	8	3872	July 30
Wilder	6.25	3025	Aug. 2
Concord	7.50	3630	Aug. 2
Delaware	11	5324	Aug. 2
Muench	45	21780	Aug. 25
Herbemont	35	16940	Aug. 30
Ronalda	21	10164	Aug. 25
Carmen	Small crop		July 30
Muscadine Grape Summary			
	(286 vines)		
Flowers	25	7150	Sept. 15
Thomas	75	21450	Sept. 15
James	40	11440	Sept. 15
Scuppernong	23	6578	Sept. 15

The test of European grapes grafted on Lenoir stocks has been a failure and all vines are dead.

As in 1925, the various varieties of citrus fruits under test have made fine growths in 1926. Unfortunately for the test of citrus fruits, a sudden drop in temperature came last winter on December 28 and killed back to the dirt banks practically all varieties of round oranges and grapefruit. Duncan grapefruit and Lue Gim Gong round orange were, however, suf-

ficiently resistant to the cold for about half of the 1925 growth to survive. In the case of satsumas only a few trees lost some leaves from the freeze. These produced crops of fruit this year of from one to ten dozen oranges per tree. The Thomasville Citrangequats and the two varieties of Kumquats also exhibited high resistance to the cold. The latter made a large crop of fruit. The Tangelo was killed back by the temperature of 14.5 degrees F., as were the round oranges. Tangerines seem to be as resistant to cold and otherwise as hardy as satsumas, but produce smaller crops of fruit which is of much poorer quality than the latter. The Mayer lemon was also killed back to embankment. Temple oranges on both rough lemon and sour orange stocks, have been apparently unsatisfactory here, making small growths and being easily killed by cold.

The several species of Rubus, briar berries, from foreign countries furnished this station by the Department of Agriculture at Washington, continue to be very unfavorable here. Thornless dewberry is apparently adapted and would be suited for home garden plantings. Also, the Van Fleet Raspberry received from Washington through Prof. A. B. McKay of A. & M. College has been fairly favorable, producing a good crop of berries this year. Good growths of this berry have been secured and additional plantings will be made.

Through cooperation of The Joseph J. White Nurseries of Whitesbog, N. J., there was secured a duplication this year of the varieties of northern blueberries which were planted here in 1925 and died the same season. These varieties are Cabot, Adams, Pioneer, Sam, Grover, Harding, and Rubel. Instead of clean cultivation, mulching was used on the plat this year and all except Adams lived through the season and made fair growths.

Watermelons—Realizing the need for some work being done in this section with varieties of watermelons, as indicated by numerous letters of inquiry, there was started some preliminary work here in 1926. Seed were secured of the New Schochler, New Perfection, Ice Cream, Irish Gray, Wonder, Stone Mountain, and Tom Watson. These were planted on new land well prepared and fertilized. During the season a close record was kept of the early fruiting habit of the various varieties, their relative resistance to drouth, and their ability to produce large melons in quantity which also have marketable quality. This work will be continued next year, including only the most favorable out of the above and securing additional varieties.

Strawberries—Variety work with strawberries, from which a record was not reported in 1925 due to the new plantation not bearing fruit last year, made a good crop in 1926 and the table below (No. 8) shows results obtained, also Table No. 9 shows average results for three years with the varieties tested. This experiment is being discontinued and the conclusions drawn are that the Klondyke variety is without question the best of those tested for commercial planting in this section and that for home use the Missionary variety might be added to Klondyke advantageously.

TABLE No. 8—STRAWBERRY VARIETY RECORD, 1926

Variety	Total crates per acre (24 qts.)	Rank—Basis of Yield	Drouth resistance	Earliness	Shipping qualities
Progressive	81	6	6	2	5
Gandy	164	3	3	3	3
Missionary	278	1	1	1	2
Aroma	118	5	2	5	6
Lady Thompson	122	4	4	4	4
Klondyke	280	2	5	1	1

TABLE No. 9—STRAWBERRY VARIETY RECORD FOR THREE YEARS

Variety	Average yield per acre in 24 pt. crates	Rank—Basis of Average yield	Drouth resistance	Earliness	Shipping qualities
Progressive	148	6	6	2	5
Gandy	212	3	3	3	3
Missionary	330	1	1	1	2
Aroma	151	5	2	5	6
Lady Thompson	202	4	4	4	4
Klondyke	287	2	5	1	1

CULTURAL TESTS

Tests in Certified Irish Potato Seed—Many gardeners and truck growers of South Mississippi often find that Irish potatoes fail to produce profitable crops, even though they are planted on fertile soil and grown under favorable weather conditions. Observation shows that this condition results from a lack of attention to the quality of seed stock planted. Seed potatoes are usually bought in this section from the local grocer or a local seed house without any guarantee. In some sections there has been cultivated a demand for good seed potatoes and at the same time there has grown up in certain sections of the North and Middle West a business of growing what is called certified seed potatoes. In those states regulations are rigidly enforced requiring each grower who sells seed potatoes to have his crop inspected according to certain standards set up for certified seed.

Some of the southern growers are now planting certified seed potatoes entirely. Little experimental work has been done in Mississippi, and none in South Mississippi before this year, with certified seed potatoes. Realizing the demand for such work, quantities of seed stock of the Bliss Triumph variety were secured this year from several sources at the North and planted here side by side with uncertified seed bought locally. The experiment was carried on with five replications of one row plats containing 1-85 acre each. The seed were not secured until very late in the season and were not planted until April 1. This, of course, influenced the yields obtained but a comparison of the results will indicate the value of certified seed. When the potatoes were harvested they were divided into U. S. Standard grades No. 1 and No. 2 of marketable tubers and No. 3, consisting of culls. Below is a table summarizing the results of this year's test.

TABLE No. 10—IRISH POTATO STRAIN TEST—SUMMARY, 1926

Source of Seed	Yield bu. per acre			Per cent increase over Uncertified in No. 1 and 2
	No. 1	No. 2	No. 3	
Spooner, Wis.	34.8	17.2	9.9	68.8
Eagle River, Wis.	33.3	17.0	12.1	63.3
Bozeman, Mont.	33.7	12.1	10.6	48.7
Alliance, Nebr.	33.7	15.0	8.7	58.0
Local, uncertified	18.4	12.4	10.6	—

By studying the table above it may be seen that decided increase was obtained by the use of certified seed. The average of the four certified strains in bushels of No. 1 tubers per acre was 33.8, while the uncertified strain yielded only 18.4 of No. 1 tubers. This experiment has created a good deal of interest in this section this year and will be continued in 1927, but it will be cooperative with the State Plant Board, the Main Experiment Station, and the Raymond Branch Station. Through this cooperation the station will be able to get the services of a trained Plant Pathologist who will assist in making careful and exact Mosaic and other disease counts which will add much to the data for 1927. Efforts are being made to have several additional strains of the Triumph variety in the test next year.

Peaches—The work started here six years ago with sod culture, continuous clean culture, and alternating clean and sod culture, with peaches has been continued this year as in the past. A watch has been kept of the nematode infestations and not yet has the injury been sufficient to note differences. While it is interesting to note the vast difference in the amount of growth made by the several plats, there is quite a difference in the production of fruit. Also, this year the average production of Hiley trees on permanent clean culture was 4.5 bushels, on alternating sod 2.8 bushels, and on permanent sod 1 bushel. Half of each plat is planted to Elbertas, and the average production of trees on permanent clean culture this year was 3.7 bushels, on alternating sod 1.6 bushels, and on permanent sod .8 bushels. These figures show that there is certainly a relationship between cultivation of peach orchards and the amount of fruit produced, regardless of fertilization, spraying, or variety.

Figs—The same kind of work as that done in the past with sod versus clean culture with figs is still being continued. No data of benefit have been secured from this experiment, however, and it is planned to discontinue it. The trees on sod made very small growths, are very easily winter-killed, and produce no fruit at all.

DUSTING AND SPRAYING TESTS

Peaches—There being such a demand for information about dusting instead of spraying for control of summer pests on peaches, some preliminary work was started here in 1926 comparing the control obtained from applications of dust with that obtained from application of spray. Good power machines were used for dusting and spraying. A block of Early Rose, Slappy, and Georgia Belle trees were divided equally into two plats, the dividing line running crosswise the rows, so that there were in each plat the same number of trees of each variety. Niagara "Wettex" was used for the spraying according to the manufacturer's recommendations, and the

same company's "Peach Dust" was used in dusting. Large crops of excellent colored fruit were harvested from the trees in both plats, and there was no perceptible difference seen in the control of pests. This test is planned for next year, when a record will be kept to show the costs of the two kinds of control as well as the amount of control obtained from each material.

Grapes—There was also some preliminary work started here this year testing the use of dusts instead of Bordeaux for the control of summer pests on grapes. "Birodust", made by Niagara Sprayer Company, was used in this work and applied to one row in the vineyard while home-mixed Bordeaux with arsenate of lead added was applied to a duplicate row. A slight difference in the control of leaf diseases was noticed on the two rows in favor of Bordeaux mixture, but no difference was seen in the control of diseases on the fruit. This experiment will also be conducted next year in such a way as to secure more detailed data.

COOPERATIVE TESTS

European Grapes—The test in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture with European grapes grafted on American varieties as stocks in an effort to establish disease resistance in the former, has been continued this year. Since the last report of this work others of these combinations have died out, and a summary of observations for the year shows the following: (There were originally six vines in each combination.)

All Muscat-Hamburg on Catawba, Missouri Reisling, and Brilliant are dead; on Ives, two are living, one of which made a total growth of five feet, and the other fifteen feet, a few clusters of fruit being produced by the latter.

All Chasselas-Fontainbleau on Catawba, Missouri Reisling, and Brilliant are dead; on Ives, four are alive, of which one made eight feet total growth and no fruit, one twenty-five feet and bore fruit, and two fifteen feet each and bore fruit.

All Malaga on all stocks are dead.

All Sultanina on all stocks are dead.

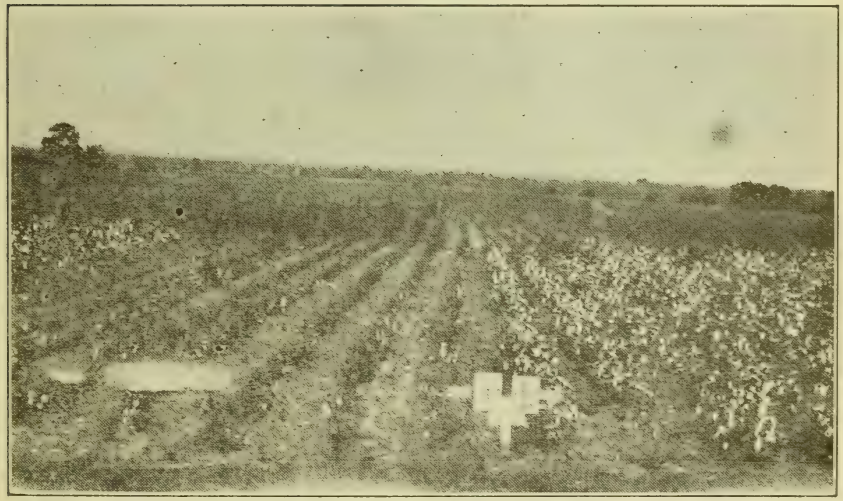
Of the above sixteen combinations of the two types of grapes, none seem very promising at present, although Chasselas-Fontainbleau on Ives appears favorable as to vigor of growth and hardiness. Any plantings of grapes of this kind should yet be done only experimentally.

Pear Stocks—The cooperative pear stock propagation tests started in 1923, in which Mr. F. C. Reimer of the Experiment Station at Talent, Oregon, furnished several trees of two species of pear used for stocks in that section to our station for growth and rooting of cuttings, has been continued this year. One hundred cuttings each were made of Pyrus calleryana No. 1 and No. 2 about December 1, 1925, and lined out in the nursery row. None of the cuttings of either type rooted this year. The trees sent by Mr. Reimer are exceedingly vigorous in growth and are now at least twelve feet high with a six-foot spread of branches. No appearance of any disease has been observed on any of the trees. This test will be continued in 1927.

Bulletin No. 239 December, 1926

REPORT
HOLLY SPRINGS BRANCH EXPERIMENT STATION
1926

By
C. T. AMES



Fertilized versus unfertilized cotton. 1926

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College, Mississippi
J. R. RICKS, Director

Report of Holly Springs Branch Experiment Station—1926

The work of the Holly Springs Branch Station has been continued along the line towards the development of successful and progressive agriculture for this section of the state. More work is planned and executed this year than at any time in the history of the station. The effect of this work can be plainly seen on the farms of this section, and the crops produced. While the dry summer had much to do with the large cotton crop produced, fertilizers, close spacing, good varieties, improved cultural methods, etc., also played a most important part.

The cotton hopper did great damage in spots, especially those highly fertilized. Two or three applications of finely ground sulphur were dusted on the plants with some degree of success. However, the hopper was not discovered until considerable damage had been done. This made the control much harder. We had cotton with practically no bolls within two feet of the ground which later, on account of favorable seasons, produced more than a bale of cotton per acre. Had this hopper damage been discovered in its early stage and the fight started sooner, the work probably would have been more effective.

The boll weevil damage was very slight in this section of the state. There were not enough weevils on the farm at any time this year to necessitate the use of poison. Only the late cotton was affected to any great extent.

The army worm did much damage on many farms. Many farmers could have easily controlled this damage by the use of poison. Frequent showers during the presence of the army worm caused the neglect in the use of poison. In many instances three applications of calcium arsenate were made before the worms were destroyed. This appeared to many to be expensive and they were unwilling to invest about fifty cents per acre for the poison alone for each application.

The past three years have been extremely good cotton growing seasons. It is hardly probable that weather conditions will be so favorable this coming season, but it should be remembered that the cotton growing sections are doing better farming than they did a few years ago.

The most hazardous thing that the South could do would be to produce another bumper cotton crop in 1927. The crop must be reduced even more than the twenty-five per cent now proposed. In our opinion another crop like the one this year would bankrupt the South. We are not in sympathy with the proposed plan advocated by some of growing cotton without using commercial fertilizer. If the South will do this next year, and in the future do what has been advocated for the past twenty-five years and longer, namely, grow corn, hay, and in some instances hogs, sheep, dairy or beef cattle, poultry, etc., enough for farm needs and in many instances to spare, and then all the cotton they can, by use of fertilizers or any other

method, real prosperity will follow. Cotton is the South's best money crop, but why grow cotton to buy corn and hay to feed to work stock to grow more cotton, when practically everything we need on a farm can be grown as profitably, in most instances, as they can anywhere in this country.

We deem it unwise to introduce many new crops, unless they are to be supervised and properly marketed by experts. The man that is selling butter-fat, eggs, etc., in addition to cotton, is not as badly hurt as the all-cotton farmer. This state as a whole is in good shape. Some have hopes of legislation controlling the future acreage of cotton in the South. At present the law of supply and demand is the only law of force.

Cooperative fertilizer tests were conducted at Durant and New Albany in addition to both a hill and valley land test of the same kind on the station farm. Three sets of plots, composed of fifty-one plots each, were used in each test. The soil was selected and fertilizer applied under station supervision in all instances. All pickings were under the supervision of the station except the plots at Durant, which were picked and, we believe, properly weighed under the supervision of Mr. H. O. Jones, Secretary of Durant Chamber of Commerce.

Soil improvement has had our attention at all times. Almost every acre of land on the farm grows either a summer or winter legume each year. Special attention has been given cotton spacing, and variety studies have been made also with corn, sweet potatoes, soybeans, alfalfa, lespedeza, and vetch. Dairying and pasture grasses have had their places in the year's work.

Controlling surface water on the farms of the South is of first importance. It is practicing poor business methods to attempt to build up land by the growing of legumes and the use of farm manure, without first checking or controlling surface washing. After twenty years work on soil reclaiming projects on waste lands, in most instances it can be said that allowing surface water to go uncontrolled, thus washing away soil fertility, is an unpardonable crime against this and future generations. There are many instances in the state where soil washing does more damage in one year than ten years of continued cropping without the growing of restorative crops. When we consider that the basis of successful agriculture is fertile soils, how can we allow such destruction on our farms?

One year this station grew two bales of cotton per acre on land that had been improved by the growing of legumes after stopping the surface washing. An average of about one and one-fourth bales per acre was grown this year. This included many check plots and also the use of unimproved leased land. Not over 500 pounds of fertilizer was used per acre except for experimental purposes.

COTTON

The requirements for growing cotton successfully are, a fertile soil, the judicious use of fertilizer, proper cultural methods adapted to the several cotton growing sections, and insect control. There is enough information available on any of these subjects to warrant the statement that if this informaion should be put into practice the amount of cotton grown per acre could be greatly increased. The public is in a very receptive mood for using

improved methods, as is shown by the large yield made this year. If the South can be induced to feed herself she will make progress.

In the hill section, on account of soil washing, it is advisable to have all of the vegetable matter on the surface of land during the winter, that it may assist in checking soil washing and prepare such land in the spring for planting. When sod land is to be used, such land should be turned in the fall and left rough. If sod land, fall prepared, is well disked before putting into rows, splendid results will be obtained. Valley land may be prepared for cotton during the fall and winter if the surface water is properly controlled on the land, otherwise but little is gained. We have seen unterraced hill land broken broadcast in the fall and by spring in many places all of this loose soil had been washed off. We have broken hill land ten inches deep in the fall and by spring gullies to the depth of the plowing were found over the surface.

Our practice in many instances is to seed cotton middles to vetch, or some winter cover crop, in the fall and when practicable allow this cover crop to mature in the spring or early summer and put the land to some other crop than cotton. Such crops as corn or soybeans, or the two together, are fine. We find it profitable to grow cover crops on valley land also, whether to be planted the following year to cotton or not. Vetch on good land will make a good growth in time to be turned under for cotton. There are several ways by which land can be prepared for cotton. One way is to run a furrow down in the water furrow of the old row and throw two furrows together on this furrow, or list the land. Allow the land to remain in this condition until time to apply fertilizer, which is about ten days or two weeks before planting time. Then open this list and apply the fertilizer in the furrow, or it may be applied on the list without opening. Then break the middles of the rows out with a buster and allow the land to remain until planting time. At planting time run a section harrow ahead of the planters.

A second way to prepare land for cotton is to break the land broadcast, open for the fertilizer in laying off the rows, and put the middles out with a middle breaker, after the fertilizer has been applied. This will cover the fertilizer the proper depth. Harrow ahead of the planter.

The third and last way suggested is to put the land into rows at any time before planting, open the rows and apply the fertilizer, and cover same in harrowing the land. Any of the above methods are good. The first method given was used by this station and the fertilizer was applied on the list, thus leaving a firmer seed bed in case of a dry spring. If this is not the case, either method is good. It frequently occurs that the fertilizer has to be applied just ahead of the planter, which is satisfactory.

A well prepared seed bed which has been settled by rain is ideal. When the fertilizer can be applied a week or ten days ahead of planting, the frequent rains that usually prevail in the spring will give a firm seed bed. In case of dry weather, the use of a roller after the planter is necessary.

For fertile valley land, three and one-half foot rows are sufficient. On thin upland soil, three-foot rows are very satisfactory.

Cotton planting time in this latitude is usually between April 25 and May 10. For the past three seasons the planting time was earlier than indicated. Cotton should be planted when the ground is warm enough to

cause quick germination. Going south from this place, it appears that the time of planting changes at the rate of twenty miles per day; that is, one hundred miles south of here at the Mississippi A. & M. College, the time given for planting is April 20, or five days earlier than at this station. In seven out of ten years, where cotton was planted earlier than the date given, a poor stand was secured. This necessitates a second planting late in May, which is too late for the best results.

The past three years earlier plantings succeeded better than the dates recommended. It is better to plant medium early and secure a good stand than to plant early and get a poor stand. Early planting is necessary and a good stand is very essential. Late planting and poor stands are both very unsatisfactory, often causing a failure in the crop. The easiest way to increase the yield of cotton from twenty-five to fifty per cent without one cent of additional costs, is to get a good stand of cotton. One of the mistakes made by the farmers in this section is not rushing preparation of the soil in time to plant at the proper time. Lateness in starting preparation of land means less crop to gather. Why not prepare the land ahead of time and plant the entire crop in two or three days?

On hill land a stand of cotton is from three to four stalks in bunches per foot, on valley land two to three stalks in bunches per foot. A properly balanced fertilizer is necessary to secure the best results with such spacing. In using the results in the past three years where the unthinned cotton took the lead in production, it appears that about the only excuse for thinning cotton at all is to be able to use the hoe freely in destroying weeds and grass. Blocking the cotton out, leaving the blocks twelve or fourteen inches apart, is not very far from good spacing. The best results with close spacing can only be obtained by the use of a properly balanced fertilizer.

Cotton seed should be planted very shallow in a medium elevated row. It is advisable to use from one and one-half to two bushels of seed per acre. The earlier the planting is made, the more seed should be used. A good practice is to run the planter twice down each row, using half the quantity of seed each way. The first trip will plant the seed a little deeper than the second. This method will increase the chances for a stand. Everything depends upon a good stand.

Fertilizers and varieties are discussed later under Variety Studies.

Cultivation should begin as soon as the plants are established sufficiently not to be injured. Thin or block out as soon as possible and give frequent shallow cultivation. It is a good practice to cultivate as soon as possible after each rain, but if the rains are far apart it may be necessary to cultivate more often. If any weevils can be found just as the squares begin to show or about the time the earliest squares are about half grown, calcium arsenate applied in the bud of the cotton will kill them. Either the sweet poison or the dust form will do the work. Calcium arsenate applied in the dust form, either with a hand or power machine, is very satisfactory. A second application about ten days later should be made if any weevils can be found. Results indicate that in this latitude this second application is usually made about the time most of the weevils are out of hibernation, which means that most of the weevils are destroyed. Should the weevils become plentiful later in the season, poisoning should be

begun with calcium arsenate dust as soon as ten per cent square infestation is found. Mr. B. R. Coad of the U. S. Department of Insect Control, recommends three applications, four days apart, beginning with about ten per cent infestation. After the three applications, the weevil should be held down to about twenty per cent infestation by later dustings.

VARIETY TESTS

These tests were made, one on valley and the other on hill land. The soil for the valley test was of improved brown loam.

Each variety was in one-row plots repeated four times. Valley test rows were 118 feet long, hill test rows 200 feet long.

Plantings were made April 26. The season was extremely dry. In order to secure a stand of cotton all land had to be rolled. A good rain in late summer encouraged late fruiting. The following tables, No. 1 and No. 2, give the results of these tests.

TABLE No. 1—COTTON VARIETY TEST, VALLEY LAND

Variety	Pounds per acre		Lint data			Total value per acre	Rank in value	Per cent seed cotton first picking
	Seed Cotton	Lint	per cent	Length	Cents per lb.			
Trice, Miss. Sta.	1795.8	565.7	31.5	1 f	12.95	86.79	23	58.0
Trice, Burdette	1682.4	560.2	33.3	15-16f	12.37	81.64	25	56.0
Clev. Wannamaker	2001.5	726.5	36.3	7-8f	11.67	101.81	11	29.8
Clev. Coker	1798.4	624.0	34.7	7-8f	11.67	85.73	24	25.8
Clev. 54	1972.5	668.7	33.9	15-16f	12.37	97.06	16	30.3
Clev. Wilson	1977.8	630.9	31.9	15-16	12.03	90.72	22	30.7
Clev. Piedmont	2009.4	651.0	32.4	7-8f	11.67	90.91	21	27.3
Mahon's Half & Half	1795.8	696.8	38.8	7-8	11.48	92.08	20	35.5
Cook 1010	1787.9	706.2	39.5	7-8	11.48	92.97	19	32.6
Willis	2394.4	775.8	32.4	15-16	12.03	111.13	9	39.9
Miller	1919.7	622.0	32.4	1 1-16	13.37	97.43	15	26.8
Acala	1880.2	673.1	35.8	1 f	12.95	100.45	13	32.4
Mex. Big Boll	1888.1	619.3	32.8	1 1-16	13.37	96.76	17	22.9
D. & P. L. No. 4	2122.8	747.2	35.2	1 1-16	13.37	115.03	7	32.2
D. & P. L. No. 8	2323.2	864.2	37.2	1 1-16	13.37	131.59	2	31.9
Webber Deltatype	1903.9	571.2	30.0	1 1-4f	22.37	142.44	1	29.9
D. & P. L. No. 5	1587.5	509.6	32.1	1 3-16f	17.53	101.19	12	29.1
Delfos 631	2170.3	683.6	31.5	1 3-16	16.53	129.35	3	45.0
Delfos 910	1856.4	581.1	31.3	1 3-16f	17.53	115.90	6	36.9
Delfos 911	1716.7	557.9	32.5	1 1-8f	15.37	98.50	14	44.9
Delfos 6102	1990.9	631.1	31.7	1 1-8f	15.37	111.96	8	39.7
D. & P. L. No. 6	1946.1	671.4	34.5	1 3-16	16.53	125.00	4	37.3
Lightning Express	1634.9	503.6	30.8	1 3-16	16.53	95.69	18	50.9
Lone Star 65	1977.7	652.6	33.0	1 1-16f	13.78	104.51	10	41.9
Cook 1010—315	1276.3	469.7	36.8	1 f	12.95	69.70	27	27.7
Henderson's Prolific	2283.6	783.3	34.3	1 1-16f	13.78	124.44	5	42.4
Haaga's 86	1566.4	579.6	37.0	15-16	12.03	80.58	26	30.1

TABLE No. 2—COTTON VARIETY TEST, HILL LAND

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value	Per cent seed cotton first picking
	Seed Cotton	Lint	Per cent.	Length	Cents per lb.			
Trice, Miss. Sta.	1907.7	633.4	33.2	1	12.70	94.46	10	74.6
Trice, Burdette	1668.0	585.5	35.1	15-16	12.03	82.35	16	65.8
Clev. Wannamaker	1602.7	607.4	37.9	7-8	11.48	80.68	17	43.8
Clev. Coker	1565.3	585.4	37.4	7-8	11.48	77.98	19	45.4
Clev. 54	1512.4	561.1	37.1	15-16	12.03	77.96	20	49.4
Clev. Wilson	1461.1	507.0	34.7	7-8f	11.67	69.67	27	43.3
Clev. Piedmont	1626.0	574.0	35.3	7-8	11.48	77.47	21	48.0
Half & Half, Mahon's	1428.4	599.9	42.0	13-16f	11.15	76.00	23	45.2
Cook 1010	1391.1	578.7	41.6	13-16f	11.15	73.47	24	45.9
Willis	1727.2	620.1	35.9	7-8f	11.67	84.55	15	55.9
Miller	1331.9	479.5	36.0	1 f	12.95	71.48	25	30.0
Acala	1412.8	545.3	38.6	1	12.70	78.77	18	46.5
Mex. Big Boll	1358.4	472.7	34.8	1 f	12.95	70.95	26	32.9
D. & P. L. No. 4	1510.9	592.3	39.2	1 f	12.95	86.80	13	45.3
D. & P. L. No. 8	1469.0	590.5	40.2	1 f	12.95	86.13	14	52.9
Webber Deltatype	1403.5	482.8	34.4	1 1-4	20.37	108.48	2	40.5
D. & P. L. No. 5	1512.4	533.9	35.3	1 3-16	16.53	99.01	8	45.3
Delfos 631	1764.5	605.2	34.3	1 1-8f	15.37	105.77	4	54.4
Delfos 910	1657.1	575.0	34.7	1 3-16	16.53	106.95	3	46.0
Delfos 911	1590.2	555.0	34.9	1 1-8	14.53	92.03	11	59.2
Delfos 6102	1792.5	629.2	35.1	1 1-8	14.53	104.22	5	52.1
D. & P. L. No. 6	1711.6	647.0	37.8	1 1-8f	15.37	111.15	1	49.5
Lightning Express	1563.8	514.5	32.9	1 1-8f	15.37	90.62	12	62.2
Lone Star 65	1873.4	663.2	35.4	1 1-16	13.37	101.98	7	54.4
Cook 1010—315	1425.3	544.5	38.2	15-16f	12.37	77.04	22	33.8
Henderson's Prolific	1828.3	669.1	36.6	1 1-16	13.37	102.21	6	56.2
Haaga's 86	1875.0	763.1	40.7	13-16f	11.15	97.32	9	58.5

For the third year in succession, strong growing, medium early maturing varieties came to the front. The long growing season was no doubt in their favor.

COTTON VARIETY TEST, SIX YEAR AVERAGE—1921 TO 1926

There is no doubt but that the careful selection of a variety of cotton and the judicious use of the proper fertilizer will add to the income of the grower more than anything else under their control.

The following tables give a six year average of some of the leading varieties of cotton grown at Holly Springs:

TABLE No. 3—VARIETIES GROWN ON VALLEY LAND

Years	Pounds of Lint Cotton per Acre							
	Delfos 6102	Lone Star 65	Delfos 631	Webber Delta	Miss. Sta. Trice	Acala	Miller	Clev. 54
1921	797.1	741.2	683.9	667.3	675.3	717.5	803.3	849.1
1922	269.9	259.9	192.5	112.0	224.6	293.7	249.1	214.4
1923	408.7	460.1	360.1	286.8	408.0	324.0	317.0	420.4
1924	515.6	456.0	443.7	355.2	493.2	420.8	404.2	435.4
1925	588.3	691.5	579.2	518.8	516.8	730.9	815.0	516.2
1926	631.1	652.6	683.6	571.2	565.7	673.1	622.0	668.7
Average	535.1	543.6	490.5	418.6	480.6	526.7	535.1	517.4
Value	$158.78	$153.68	$153.27	$142.73	$129.55	$131.83	$129.90	$120.25
Length	1 3-16	1 1-8s	1 1-4s	1 1-4f	1 1-16s	1 1-16s	1 1-16	1s
Per cent	31.2	32.6	31.0	29.5	30.7	35.2	32.3	33.7

Additions:	Half and Half	575.1 average lint	$117.64 Value	40.7 Per cent
	Pied. Clev.	502.4 average lint	$113.90 Value	33.0 Per cent
	Cook	524.5 average lint	$106.03 Value	37.7 Per cent
	Clev. Wanna.	505.9 average lint	$106.85 Value	35.8 Per cent

TABLE No. 4—VARIETIES GROWN ON HILL LAND

Years	Pounds of Lint Cotton per Acre								
	Delfos 631	Delfos 6102	Lone Star 65	Acala	Miss. Sta. Trice	Webber Delta	Cook	Half & Half	Miller
1921	488.5	491.8	468.0	479.7	437.6	491.8	680.3	612.3	493.4
1922	220.3	226.9	225.3	233.9	255.4	132.6	230.1	287.4	221.7
1923	241.6	230.9	299.4	261.3	256.2	155.7	252.5	240.7	202.5
1924	346.3	364.9	332.2	417.3	355.2	266.7	396.1	414.7	408.7
1925	478.6	491.2	521.6	479.1	501.0	361.8	530.3	557.4	466.5
1926	605.2	629.2	663.2	545.3	633.4	482.8	578.7	599.9	479.5
Average	396.7	405.8	418.3	402.8	406.5	315.2	444.7	452.0	378.7
Value	$115.38	$112.34	$106.22	$98.62	$102.40	$100.23	$93.11	$92.49	$89.31
Average Per cent	33.0	33.2	34.2	37.2	32.3	31.7	39.4	41.8	34.8

Additions:	Clev. Pied	399.6 average lint	$88.76 Value	35.0 Per cent
	Clev. 54	399.7 average lint	$88.82 Value	35.5 Per cent
	Clev. Wanna.	388.4 average lint	$78.65 Value	37.1 Per cent

The six year average given in Tables No. 3 and No. 4 should assist in making selections of varieties. It would probably be a mistake to discard early maturing varieties that have been to the front in the past years at this time.

Lone Star 65 came second in a six year test. This variety is especially good on upland. It is a good storm cotton, dwarf, big boll, early maturing, and easy to pick.

It appears that staple varieties can be grown on both valley and hill land if the soil is good and properly fertilized. However, as a rule, it is better to grow short staple varieties of cotton in the hill section or on the thinner land, and staple varieties on valley or the more fertile soils.

COTTON SPACING TESTS

For hill test brown loam table land was used; for valley test, fertile brown loam. The plots on valley land were three rows each, 310 by 3½ feet; on hill land, four rows each, 400 by 3¼ feet.

Lone Star 65 was the variety used and the date of planting was April 27. All plots were fertilized at the rate of 500 pounds of an 8-4-4.

TABLE No. 5—HILL SPACING TEST

Plants per foot in drill	Yield of seed cotton per acre, lbs.
4.60	1677.3
2.87	1600.3
1.90	1537.7
1.15	1515.1
.89	1487.5
.59	1470.8

TABLE No. 6—VALLEY SPACING TEST

Plants per foot in drill	Yield of seed cotton per acre, pounds
4.59	1499.2
3.01	1419.6
2.21	1550.7
1.24	1606.9
.97	1243.0
.50	1219.6

This season though dry, should be called a good cotton season. An attempt was made to use the following spaces in the row: Unthinned—to be left from the planter, three stalks per foot in bunches, two stalks per foot, one stalk per foot, one stalk every eighteen inches, and one stalk every two feet. The tables above give the actual distance used.

The cotton hopper did considerable damage in these tests and the rust also practically defoliated the plants on the valley land before the end of the fruiting season.

There is not the marked difference in spacing on either the hill or the valley test that has been found in the past. The cotton hopper may be responsible for this condition, but until we get further data our recommendation will be as follows: For valley land three and one-half foot rows and from two to three stalks per foot; for hill land three foot rows and from three to four stalks per foot. This was practiced at this station this past year and the average of cotton per acre was more than any year in the history of the station, i. e. one and one-fourth bales per acre for every acre on the farm including check plots and unimproved leased land.

COOPERATIVE FERTILIZER TESTS

This work was conducted by the Holly Springs Branch Experiment Station in cooperation with county agents, chambers of commerce, and good farmers of this section. Similar plantings were also made on the station on both valley land and slightly rolling hill land. The test made at New Albany was on the farm of Mr. D. W. Robbins. The test at Durant was on the farm of Mr. C. H. McClellan. Mr. H. O. Jones, Secretary of the Chamber of Commerce at Durant, gave very able assistance in supervising the picking.

The valley test at the station was on improved valley land that had grown legumes each year for the past sixteen years and had received applications of acid phosphate and nitrogenous fertilizers yearly. The hill land test was on unimproved leased land. The test at New Albany was on sandy loam, fairly level and typical of the Pontotoc Ridge section. The test at Durant was on brown loam and slightly rolling type.

Materials applied to the last three fertilized plots of all these tests supply approximately as much plant food to the acre as would be supplied by 1200, 1800, and 2400 pounds respectively of an 8-4-4 mixed fertilizer. All other treatments are based on approximately 600 pounds of mixed fertilizer of the analysis indicated.

In all fertilizer work reported in this bulletin the increase was obtained according to standards adopted by the American Society of Agronomy and reported in Vol. 16 No. 1 of the Journal. The column marked "check

yield" was obtained according to the above method by assuming that there is a gradual increase or decrease in fertility from one check to another.

All plots were one-twentieth acre in size, composed of four rows and in three series. Only the middle rows were used in computing yields.

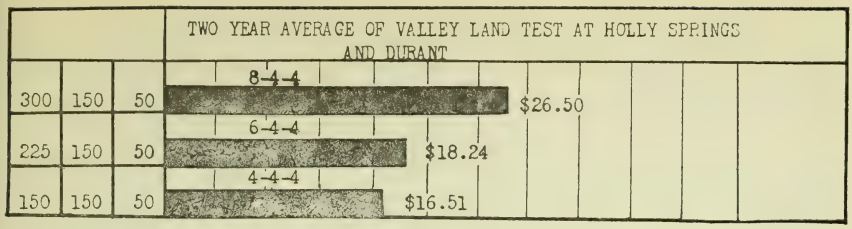
On the Station Lone Star 65 was the variety used; in the cooperative tests at New Albany and Durant Delfos 6102 was used. At the Station the planting date for valley land was April 22, for hill land April 28. The test at New Albany was planted May 5 and at Durant April 28.

TABLE No. 7—FERTILIZER TEST, VALLEY LAND—HOLLY SPRINGS

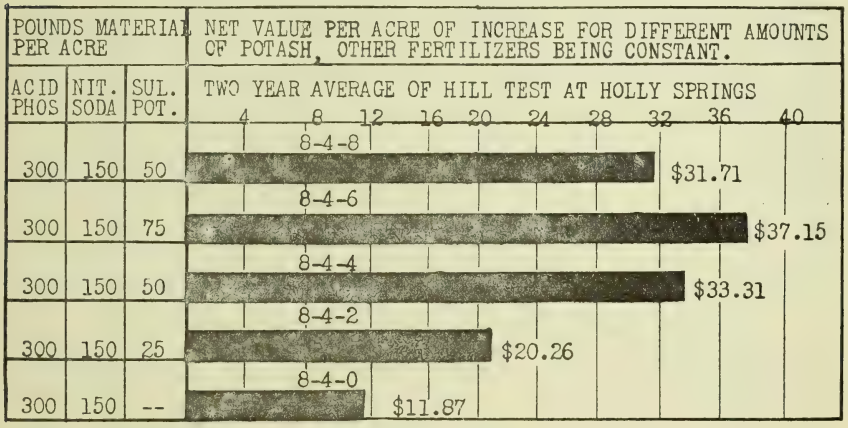
Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid Phos.	Nit. of soda	Sul. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 5c	Cost of fertilizer	Net profit
No fertilizer				1135.5	1135.5	—	—	—	—
300	150	100	8-4-8	2064.8	1156.5	908.3	45.41	9.81	35.60
300	150	75	8-4-6	1935.3	1177.5	757.8	37.89	9.14	28.75
300	150	50	8-4-4	1736.1	1198.5	537.6	26.88	8.47	18.41
No fertilizer				1219.5	1219.5	—	—	—	—
300	150	25	8-4-2	1595.2	1231.9	363.3	18.16	7.80	10.36
300	150	—	8-4-0	1359.0	1244.3	114.7	5.73	7.13	—1.40
300	300	50	8-8-4	1780.2	1256.7	523.5	26.17	12.98	13.19
No fertilizer				1269.3	1269.3	—	—	—	—
300	225	50	8-6-4	1763.1	1244.3	518.8	25.94	10.68	15.26
225	150	50	6-4-4	1592.3	1219.3	373.0	18.65	7.80	10.85
150	150	50	4-4-4	1485.6	1194.3	291.3	14.56	7.12	7.44
No fertilizer				1169.7	1169.7	—	—	—	—
600	300	100	8-4-4	1932.4	1194.7	737.7	36.88	16.93	19.95
900	450	150	8-4-4	2053.4	1219.7	833.7	41.68	25.40	16.28
1200	600	200	8-4-4	2302.4	1244.7	1057.7	52.88	33.86	19.02
No fertilizer				1269.3	1269.3	—	—	—	—

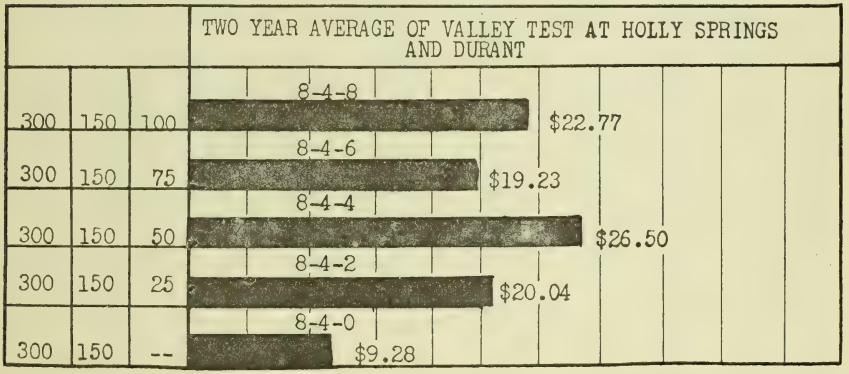
TABLE No. 8—FERTILIZER TEST, HILL LAND—HOLLY SPRINGS

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nit. of soda	Sul. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 5c	Cost of fertilizer	Net profit
No fertilizer				403.0	403.0	—	—	—	—
300	150	100	8-4-8	1356.0	464.2	891.8	44.59	9.81	34.78
300	150	75	8-4-6	1608.6	525.4	1083.2	54.16	9.14	45.02
300	150	50	8-4-4	1597.6	586.6	1011.0	50.55	8.47	42.08
No fertilizer				647.8	647.8	—	—	—	—
300	150	25	8-4-2	1448.3	666.7	781.6	39.08	7.80	31.28
300	150	—	8-4-0	1171.6	685.6	486.0	24.30	7.13	17.17
300	300	50	8-8-4	1797.4	704.5	1092.9	54.64	12.89	41.75
No fertilizer				723.6	723.6	—	—	—	—
300	225	50	8-6-4	1216.6	723.1	493.5	24.67	10.68	13.99
225	150	50	6-4-4	1221.0	722.6	498.4	24.92	7.80	17.12
150	150	50	4-4-4	1168.3	722.1	446.2	22.31	7.12	15.19
No fertilizer				721.4	721.4	—	—	—	—
600	300	100	8-4-4	1381.3	678.3	703.0	35.15	16.93	18.22
900	450	150	8-4-4	1540.5	635.2	905.3	45.26	25.40	19.86
1200	600	200	8-4-4	1538.3	592.1	946.2	47.31	33.86	13.45
No fertilizer				549.0	549.0	—	—	—	—



NOTE:- The above graphic results represent two years work only. These two years were out of the ordinary, both ideal cotton years.





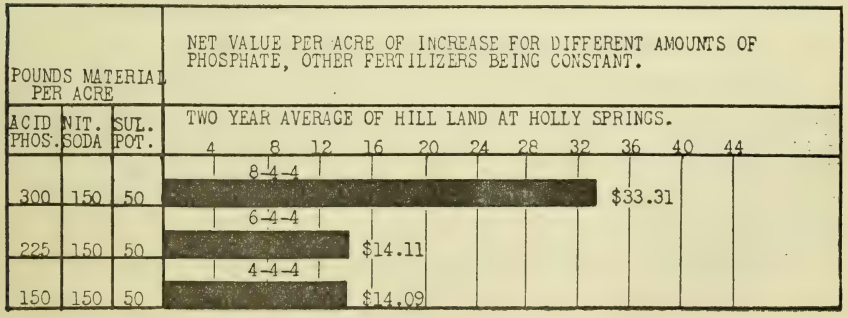


TABLE No. 9—COOPERATIVE FERTILIZER TEST—DURANT

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nit. of soda	Sul. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 5c	Cost of fertilizer	Net profit
No fertilizer				727.0	727.0	—	—	—	—
300	150	100	8-4-8	1503.4	723.7	779.7	38.98	9.81	29.17
300	150	75	8-4-6	1376.7	720.4	656.3	32.81	9.14	23.67
300	150	50	8-4-4	1412.7	717.1	695.6	34.78	8.47	26.31
No fertilizer				713.7	713.7	—	—	—	—
300	150	25	8-4-2	1276.6	750.4	526.2	26.31	7.80	18.51
300	150	—	8-4-0	1087.2	787.1	300.1	15.00	7.13	7.87
300	300	50	8-8-4	1390.0	723.8	666.2	33.31	12.89	20.42
No fertilizer				860.4	860.4	—	—	—	—
300	225	50	8-6-4	1543.4	943.8	599.6	29.98	10.68	19.30
225	150	50	6-4-4	1293.9	1027.2	266.7	13.33	7.80	5.53
150	150	50	4-4-4	1360.7	1110.6	250.1	12.50	7.12	5.38
No fertilizer				1193.9	1193.9	—	—	—	—
600	300	100	8-4-4	1634.2	1133.9	500.3	25.01	16.93	8.08
900	450	150	8-4-4	1654.2	1073.9	580.3	29.01	25.40	3.61
1200	600	200	8-4-4	1680.8	1013.9	666.9	33.34	33.86	—.52
No fertilizer				953.8	953.8	—	—	—	—

TABLE No. 10—COOPERATIVE FERTILIZER TEST—NEW ALBANY

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nit. of soda	Sul. of potash	Analysis	Plot yield	Check yield	Increase	Value of increase at 5c	Cost of fertilizer	Net profit
No fertilizer				458.0	458.0	—	—	—	—
300	150	100	8-4-8	999.2	479.1	420.1	26.00	9.81	16.19
300	150	75	8-4-6	992.6	500.2	492.4	24.62	9.14	15.48
300	150	50	8-4-4	961.5	521.3	440.2	22.01	8.47	13.54
No fertilizer				542.3	542.3	—	—	—	—
300	150	25	8-4-2	960.4	553.1	407.3	20.36	7.80	12.56
300	150	—	8-4-0	909.4	563.9	345.5	17.27	7.13	10.14
300	300	50	8-8-4	1235.4	574.7	660.7	33.03	12.89	20.14
No fertilizer				585.6	585.6	—	—	—	—
300	225	50	8-6-4	1223.2	531.2	692.0	34.60	10.68	23.92
225	150	50	6-4-4	941.5	476.8	464.7	23.23	7.80	15.43
150	150	50	4-4-4	892.7	422.4	470.3	23.51	7.12	16.39
No fertilizer				368.2	368.2	—	—	—	—
600	300	100	8-4-4	1264.3	369.0	895.3	44.76	16.93	27.83
900	450	150	8-4-4	1375.2	369.8	1005.4	50.27	25.40	24.87
1200	600	200	8-4-4	1421.7	370.6	1051.1	52.55	33.86	18.69
No fertilizer				371.5	371.5	—	—	—	—

FERTILIZER TEST ON FINLEY FIELD

The soil on this field is very thin brown loam of somewhat uneven fertility. This land has been in cultivation for fifty or more years without ever having been planted to restorative crops of any kind. This is the fifth year these plots have been used. Results in 1923 and 1924 were so poor that they were not published. This land is typical of thousands of acres in this section.

The plots were 1-23.84 of an acre each, composed of seven rows and

planted in four series. Three series were planted to cotton. The rows were three feet wide.

Cleveland 019 was the variety used. It was planted April 28, 1926, and picked October 1 and November 30.

TABLE No. 11—COTTON FERTILIZER TEST

Pounds of material applied per acre				Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nit. of soda	C. S. Meal	Kainit	Plot yield	Check yield	Increase	Value of increase at 5c	Cost of fertilizer	Net profit
No fertilizer				662.8	662.8	—	—	—	—
250	100	200	100	1246.1	593.0	653.1	32.65	9.48	23.17
250	100	200	75	1163.4	523.2	640.1	32.00	9.26	22.74
250	100	200	50	1044.2	453.4	590.8	29.54	9.03	20.51
No fertilizer				383.8	383.8	—	—	—	—
250	100	200	—	839.2	355.2	484.0	24.20	8.58	15.62
150	100	200	75	964.0	356.6	637.4	31.87	8.36	23.51
350	100	200	75	984.6	298.0	686.6	34.33	10.16	24.17
200	100	200	75	921.9	269.4	652.5	32.62	8.81	23.81
No fertilizer				240.8	240.8	—	—	—	—
250	50	200	75	770.9	265.0	505.9	25.29	7.79	17.50
250	150	200	75	1076.0	289.2	786.8	39.34	10.72	28.62
250	—	200	75	753.4	313.4	440.0	22.00	6.32	15.68
250	100	—	75	897.2	337.6	559.6	27.98	5.86	22.12
No fertilizer				361.6	361.6	—	—	—	—
300	100	200	100	1139.6	413.3	726.3	36.31	9.93	26.38
300	100	200	75	1112.6	465.0	647.6	32.38	9.72	22.66
300	100	200	50	1108.5	516.7	591.8	29.59	9.48	20.11
300	100	200	—	1087.1	568.4	518.7	25.93	9.03	16.90
No fertilizer				620.0	620.0				

In the several cooperative fertilizer tests given in the foregoing tables the following data are found:

In the Station Hill Land Test (Table No. 8) Plot 3, fertilized with 600 pounds of an 8-4-6 mixture gave an increase of 1083.2 pounds of seed cotton and a net profit of $45.02 per acre. Plot 4 of the same test, fertilized with 600 pounds of an 8-4-4 mixture gave a profit of $42.08.

In the Station Valley Test Plots 2 and 3, fertilized with 600 pounds 8-4-8 and 600 pounds 8-4-6 respectively, gave a net profit of $35.60 and $28.75.

In the New Albany test, Plot 14, fertilized with 1200 pounds of an 8-4-4 mixture. gave a profit of $27.83.

The plots at Durant that gave the best results were Plots 2, 3, and 4. Each of these plots was fertilized with 600 pounds of the following formula: Plot 2, 8-4-8, profit $29.17; Plot 3, 8-4-6, profit $23.67; Plot 4, 8-4-4, profit $26.31.

There is no marked difference in the fertilizer requirements in the several sections in which these results were obtained. It appears that phosphorus, nitrogen, and potash in combination give the best results. It appears in a majority of cases that about 600 pounds of fertilizer was the most economical quantity to use this year.

Taking into consideration our past results at the station and at various points in North Mississippi, we find no marked difference in the require-

Fig. 1—Check plot. No nitrate applied.

Fig. 2—Plot on which 200 pounds of Lime Nitrate was applied.

ments in this part of the state this year from any year in the past. The outstanding fact is that phosphorus and nitrogen are deficient and possibly potash to some extent, and that a fair amount of a complete fertilizer will increase the yield of cotton very materially, frequently doubling the yield per acre, as can be seen in data given.

The cotton farmer in this section should use a mixture of 200 pounds acid phosphate, 100 pounds nitrate of soda, and 25 pounds of sulphate or muriate of potash, or 100 pounds of kainit. This mixture should be applied at the rate of from 400 to 600 pounds per acre. An 8-4-4 ready mixed fertilizer can be used instead of the home mixture, provided the greater part or most of the nitrogen is from a readily soluble source.

From previous years results, it appears that as much as 1000 pounds of a well balanced fertilizer will pay most years. Results also indicate that where the soil has been materially improved by the use of legumes and other farm practices, excellent yields can be obtained without any enormous investment in expensive fertilizers. On land where red rust affects the plants, 200 pounds of kainit is recommended.

POTASH SOURCES TEST

The soil used for this was unimproved sandy loam valley land. The plots were one-twentieth acre each, consisting of four rows each, forty inches wide and 164 feet long. Only the two inside rows were used in the test. All plots were in triplicate.

Miss. Sta. Trice cotton was planted April 27.

Each potash carrier given in the table below was applied at such a rate as to supply 24 pounds of available potash per acre.

TABLE No. 12—POTASH SOURCES TEST

Pounds of material applied per acre	Pounds of seed cotton per acre			Per cent increase	Rank
	Plot yield	Check yield	Increase		
No potash	1450.3	1450.3	—	—	—
50 Muriate of potash	1867.5	1516.1	351.4	23.18	1
41.7 Trona	1600.9	1581.9	19.0	1.20	4
No potash	1647.6	1647.6	—	—	—
50 Sulphate of potash	1786.2	1636.5	149.7	9.15	3
200 Kainit	1987.5	1625.4	362.1	22.28	2
No potash	1614.3	1614.3	—	—	—

NOTE—All plots including checks, received in addition to the potash, 300 pounds of acid phosphate and 150 pounds of nitrate of soda per acre in order that deficiencies in these would not render the potash comparison worthless.

NITROGEN SOURCES TEST

This test was conducted on unimproved sandy loam valley land. The plots were one-twentieth acre each, consisting of four rows each, forty inches wide and 164 feet long. Only the two inside rows were used in the test. All plots were in triplicate.

Miss. Sta. Trice was the variety used and was planted April 27.

Each nitrogen carrier given in the table below was applied at such a rate as to supply thirty pounds of available nitrogen per acre.

TABLE No. 13—NITROGEN SOURCES TEST

Pounds of material applied per acre	Pounds of seed cotton per acre			Per cent increase	Rank
	Plot yield	Check yield	Increase		
No nitrogen	795.8	795.8	—	—	—
200 Nitrate soda	1387.6	849.8	537.8	63.29	1
150 Ammonium sulphate	1345.0	903.8	441.2	48.82	4
115.5 Leunasalpeter	1487.6	957.8	529.8	55.23	2
No nitrogen	1011.7	1011.7	—	—	—
138.9 Calcium cyanamid	1163.7	988.7	175.0	17.70	6
200 Lime nitrate	1390.3	965.7	424.6	43.97	5
65.2 Urea	1427.6	942.7	484.9	51.44	3
No nitrogen	910.8	910.8	—	—	—

NOTE—All plots, including checks, received in addition to the nitrogen, 400 pounds of acid phosphate and 47 2-3 pounds of sulphate of potash per acre, in order that the deficiencies in these would not render the nitrogen comparison worthless.

CORN

At this Station all corn is grown after some legume, principally vetch. As a rule, early planting on thin land is advisable. The seasons are usually more favorable about the time corn begins to fruit than they are when later plantings are made. When plantings are made in this latitude earlier than the latter part of April, the results are often a poor stand. On rich soils earlier plantings can be made with safety. Thin land is a poor place to grow corn, but for that matter, thin land is a poor place to try to grow any cultivated crop. Our method is to turn the land that is planted to a legume about the time blooming begins, disk the land thoroughly, and after a rain harrow and plant on a level.

On land where vetch is grown and allowed to mature some seed and is then harvested for hay, this land should be turned preferably with a disk plow, or a plow with a rolling coulter attached to prevent choking up. Harrow and plant on a level. Usually the land that is planted in vetch has sufficient moisture in it to permit planting immediately after preparation. After the land is turned, one good rain to settle down the soil almost insures a good crop of corn, if proper cultivation is made. This work is done about the first half of June.

We advise planting Otootan, Laredo, or Mammoth Yellow Soybeans in every row of corn. If it is a dry year, the yield of corn will be reduced to some extent, but the two crops are much more valuable than corn would be alone. It is a good practice to plant two rows of corn and one row of soy or velvet beans if the same number of stalks are left on the two rows as would be left if all three rows were planted to corn. The yield will be reduced but little, and the soil will be greatly helped by the addition of vegetable matter. The Laredo or Otootan soybean will stand more water than corn. Unsafe wet land can be planted with corn to either of these varieties and if the corn is drowned out the beans will make a crop. Much of the wet land in this country could be planted to these beans for forage, and in this way unsafe land could be changed to growing a safe, profitable crop. Beans should be planted in every row of corn in this state. This will act as a soil restorer. The beans will keep down weeds and grass to some extent and shade the ground during the summer. Three or four

beans dropped every twelve or fourteen inches will give satisfactory results. It is easy to find corn and bean planters that drop alternate hills of corn and beans. At this Station, one hill of corn is destroyed later, leaving two hills of beans to one of corn. In the absence of this combination planter, a planter dropping beans can follow the one dropping corn. Beans will stand as early planting as corn.

Corn should be planted very shallow and on well prepared seed beds. Corn is an outstanding crop on well prepared seed beds. Good preparation is half the cultivation with corn. We prefer wasting seed corn in order to insure a good stand. Seventy-five per cent of the farmers do not put down enough seed to insure a good stand. On average land when a forty-two inch row is used, one stalk every thirty inches is a fair distance. As land increases or decreases in fertility, the distance should vary. The more fertile the land, the more closely the corn can be grown; and the thinner the land, the wider the distance should be.

No land should be planted to corn that will not produce more than twenty bushels per acre. It requires about twenty bushels of corn to pay the cost of cultivation per acre, when rent and other expenses are considered. It is easy to leave too much corn on the land for the best results. Thin land should be planted to legumes and not to corn. More feed will be secured by such a method and the land will become better. When deep cultivation is practiced, it should begin when the plants are small and should be kept up at frequent intervals. This method is more applicable for early plantings. For June planting, medium shallow cultivation is advisable. Four or five cultivations on late plantings are usually sufficient for good results. Run the cultivator about the same depth at each cultivation, regardless of methods used.

TABLE 14—CORN VARIETY TEST, 1926

PLOTS—One row each planted in checks, repeated seven times, rows three and one-half feet apart and a hundred and twenty-three feet long.

PLANTED—April 29, 1926.

FERTILIZER—Two hundred pounds of acid phosphate and a hundred and fifty pounds of nitrate of soda; applied after turning under a good sod of crimson clover.

Variety	Yield in bushels per acre	Per cent of grain	Rank
Mosby, Sta.	69.5	80.5	5
Mosby, Delta	66.5	79.3	7
Mosby, Lee	73.4	82.6	3
Mosby, Suttle	53.0	80.0	14
Cocke's Pro. Sta.	66.2	73.9	8
Cocke's Pro. Delta	68.7	80.5	6
Hastings	82.1	80.4	1
Johnson Prolific	58.1	78.8	12
Delta Prolific	66.2	79.2	8
Mexican June	52.1	72.4	15
Laguna	58.3	76.0	11
Ellis	58.9	74.1	10
Paymaster, Neal	70.6	80.3	4
Paymaster, Fisher	76.9	82.4	2
Yellow Dent, Ferg.	45.9	74.9	18
Yellow Dent, Station	49.3	74.2	17
Golden Dent, Ullathorne	53.7	69.6	13
Golden Dent, Station	50.6	70.7	16

The soil on which this test was conducted was highly improved and the yield was controlled by the limited amount of soil water.

TABLE 15—VARIETIES OF CORN, SIX YEAR AVERAGE, 1926

Year	Neal's Paymaster	Hasting's Prolific	Mosby Station	Cocke's Delta	Cocke's Station	Laguna
1921	43.71	—	46.55	35.78	39.52	38.44
1922	76.22	53.92	55.56	56.15	54.53	48.63
1923	79.51	72.80	64.73	72.81	72.51	63.62
1924	68.77	43.02	50.35	51.79	56.70	49.93
1925	62.09	73.97	59.87	60.75	62.57	51.20
1926	70.60	82.10	69.50	68.70	66.20	58.30
Average	66.82	65.16	57.76	57.66	58.67	51.69

It will be noted that Hasting's Prolific has only been in the test five years. It comes second in yield in average test, but was first the past year. Neal's Paymaster has been in the lead at this Station for some time and it is in the lead on a six year average test. Some objections are found in this variety by some growers. It is a large, red cob, two eared variety, that is hard to beat.

TABLE 16—CORN FERTILIZER TEST, 1926

SOIL—Unimproved sandy loam valley land that has been subject to overflow.
PLOTS—One-twentieth acre each, triplicated.
PLANTED—May 29, 1926.
VARIETY—Neal's Paymaster.

Pounds of material applied to the acre	Bushels per acre			Dollars per acre		
	Plot yield	Check yield	Increase	Value of increase at $1.05 per bu.	Cost of fertilizer	Net gain
No fertilizer	30.5	30.5	—	—	—	—
100 Nitrate of soda	37.1	32.5	4.6	4.82	2.93	1.90
100 Nitrate soda 200 Acid phosphate	40.9	34.5	6.4	6.72	4.73	1.99
No fertilizer	36.5	36.5	—	—	—	—
100 Nit. soda at planting 100 Nit. soda first working	39.0	36.8	2.2	2.31	5.86	—3.55
100 Nit. soda 200 Acid phos. at planting 100 Nit. soda first working	38.0	37.1	.9	.95	7.66	—6.71
No fertilizer	37.4	37.4	—	—	—	—
200 Acid phos. 200 Nit. soda	52.2	35.8	16.4	17.22	7.66	9.56
No fertilizer	34.2	34.2	—	—	—	—
400 Acid phos. 200 Nit. soda	53.2	33.4	19.8	20.79	9.46	11.15
150 Ammonium sulphate 400 Acid phos.	43.5	32.7	10.8	11.34	8.48	2.86
No fertilizer	31.9	31.9	—	—	—	—
150 Ammonium sulphate	40.3	30.9	9.4	9.87	4.88	4.99
150 Ammonium sulphate 400 Acid phos. 200 Kainit	45.0	29.8	15.2	15.96	10.28	5.68
No fertilizer	28.7	28.7	—	—	—	—

The past year was most too dry for a heavy yield of corn on this type or soil, as moisture was the limiting factor. It is risky to use much fertilizer on corn. Satisfactory results have never been obtained at this Station by the use of fertilizer with corn. It can be readily seen the kind of soil on which corn is growing. If the weather is unfavorable at fruiting time on account of too much or to little rain, the yield will be reduced. Being a comparatively short lived crop, it has not time to overcome unfavorable weather. Then, too, it is a crop of rather low money value, except on very fertile soils. It has always been contended that poor land was a poor place on which to try to grow corn. Corn will respond to the use of fertilizer as readily as cotton, but it will not stand still and wait for rain and then make a bumper crop. Plant corn on good land and fertilize moderately. Improve the thin land by controlling soil washing and growing legumes.

Basing recommendations on these results and those formerly obtained, a mixture is recommended composed of from a hundred and fifty to two hundred pounds of acid phosphate and a hundred pounds of nitrate of soda, or the same quantity of nitrogen in other readily soluble forms per acre. In the above results, the most profitable crop was from double this quantity. It is usually expected that an increase of eight or ten bushels of corn per acre should be obtained from the use of each hundred pounds of nitrate of soda used. There is no question but that the phosphorus is necessary unless heavy applications were used on the soil in growing other crops, so that the residual effect will be had. Side dressings of nitrate of soda are frequently very beneficial if they are not made too late. However, this is frequently the case. Make the second application when the corn is about knee high, or a little later.

TABLE 17—CORN AND BEAN TEST, 1926

PLANTED—May 1, 1926, on valley land.
FERTILIZER USED—Three hundred pounds acid phosphate, and a hundred and fifty pounds of nitrate of soda per acre.

	Yield in bushels of corn per acre			
	1923	1925	1926	Average
6 Rows of corn	48.2	45.9	57.9	50.6
6 Rows of corn with soybeans	45.5	37.3	51.5	44.7
6 Rows of corn with velvet beans	31.3	31.9	38.5	33.9
6 Rows, 2 rows corn, 1 row soybeans	42.5	37.5	43.1	41.0
6 Rows, 2 rows corn, 1 row velvet beans	40.2	34.2	46.6	40.3

Dry weather prevented a much larger yield. Plant beans in corn, either in every row or in every third row. The two crops will more than equal corn alone. It is not advisable to plant velvet beans in every row of corn, because the corn will be greatly damaged by the beans if it is a wet year. During a wet season, soybeans planted in every row of corn will damage the yield of corn very little. Therefore, it is recommended that soybeans be planted in every row of corn.

SILAGE

We have found Japanese seeded ribbon cane a most excellent variety for silage purposes. This sorghum produces at least one-third more tonnage per acre on any kind of land than corn and has very nearly

the same feeding value, ton for ton. Sorghum has other advantages. Dry seasons, like the past three years, sorghum will stand the drouth better and will not damage if harvesting is delayed. This is not the case with corn. Corn blooms but once and if the weather is unfavorable during this period, the results will be poor. Sorghum will wait for rain and will recuperate after the rain. There is one thing to be guarded in sorghum—it must be mature in making a good grade of silage. Immature sorghum will make sour silage and this is very undesirable cattle feed. If sorghum is planted with a small size eight hole corn plate in the planter, the seed will be dropped in bunches about twelve inches apart and hoeing may not be necessary with proper cultivation. Sorghum grown thick in this way will produce small stalks which are more desirable for feed. In the cut below is shown sorghum grown after thirty-six hundred pounds of vetch hay was removed this spring and the sorghum averaged eighteen and four-tenths tons cut for silage.

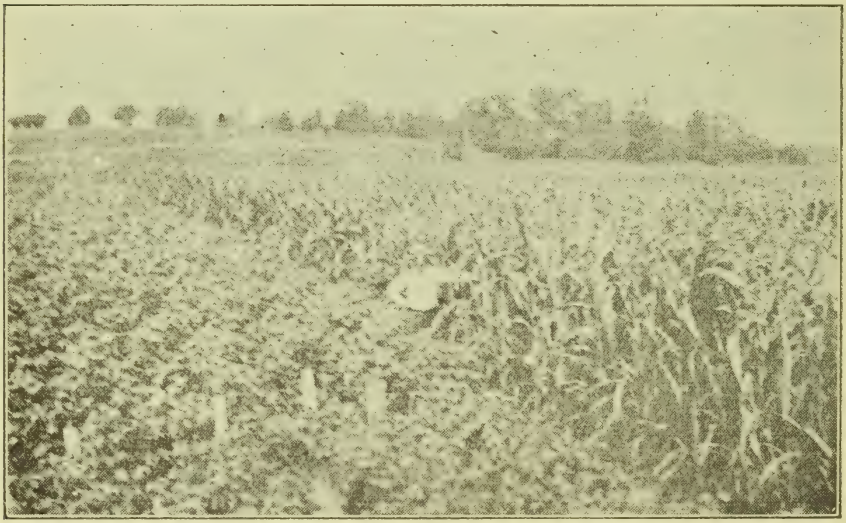


Fig. 3—Cotton and sorghum in two year rotation.

When such heavy tonnage is removed from the land, a liberal amount of fertilizer should be used. Six or eight hundred pounds of an 8-4-4 mixed fertilizer would give good results. If the weather gets very dry, the addition of a hundred pounds of nitrate of soda as a side dressing would pay. If the season is good and the soil fertile, fifteen to twenty tons of silage per acre could be expected. The average tonnage of corn silage is around ten tons per acre. Some have found it satisfactory to plant corn with sorghum in the same row. Where such plantings were made at this place, the corn was a complete failure. If a mixed silage is desired, it is recommended that plantings be made in separate fields and the mixing done at the cutter, cutting alternate loads of each.

We have been unable to find a more suitable and profitable substitute feed for dairy cows.

SWEET POTATOES

This is a crop that should be grown by every farmer and tenant on every farm in the South. The sweet potato is adapted to almost any type of soil, but probably thrives best on fertile sandy loam. As high as three hundred and fifty bushels per acre have been grown at the Station. An average crop is around two hundred bushels per acre. The sweet potato is as valuable for food as the Irish potato and does equally as well, if not better, in the South. It is well known in the South and is growing in popularity in all northern markets. The greatest drawback in sweet potato growing is disease, but this can be easily controlled with a little care. Rotation of seed bed and field used in growing potatoes and using clean seed will eliminate most of the trouble. The State Plant Board is doing untold good in fighting potato and other plant diseases that affect the economical wealth of the state.

Use only clean, sound seed potatoes. Potatoes grown from vine cuttings on land free from disease make desirable potatoes for growing plants. Sound potatoes taken from among black rot infested potatoes can be used if soaked ten minutes in a solution composed of one ounce of bichloride of mercury to eight gallons of water. All seed potatoes should have this treatment; it matters not how clean they appear. It is against the state law to sell potatoes for seed purposes that are not thus treated. However, this is not the full requirement. Proper inspection while growing in the field and also before shipment is included in the law. If the people of the state will adhere strictly to the state laws on this subject, it will be but a short time before sweet potato diseases will be a thing of the past.

Convenience for watering should have much to do with the location. Also the beds should be on land where no potatoes have been grown for the past five years. If it becomes necessary to use the same beds each year, the soil should be removed and all parts of the bed disinfected with a solution of copper sulphate, one pound to twenty gallons of water. A wooden vessel should be used in making this solution.

The only satisfactory way that has been found for growing plants is in hot beds, the heat being supplied by stable manure or artificially. If stable manure is used, the method employed by this Station is to dig a pit about twelve inches deep, five feet wide, and as long as desired. Green, moist, stable manure is placed in piles in the pit and allowed to remain until hot, the time required being about two days. After heating, the manure is spread evenly over the bottom of the pit about twelve inches deep and packed well by tramping. Cover the manure at once with about six inches of top soil. If the soil is dry it can be packed firmly. The potatoes are then placed close together without touching and covered about two and one-half inches deep with sand or woods dirt. A hot bed of this kind should not be made until ready to use. If covered with glass or canvas, better results will be had, as the bed can be protected from cold rains. This type of hot bed is common over the country. Bottom heat may be supplied from a furnace or some other method. A common method is to dig a trench about ten inches wide and twelve inches deep in the middle of the bed. This trench should have a rise of not less than one foot to twenty-five feet in length. The lower end of the trench is widened out and

deepened to be used as a furnace. Old tin or sheet iron is placed over the trench the entire length and six inches of soil put on the sheet iron. The potatoes are bedded as described above. A chimney is made of one by twelve inch plank about eight feet long. The furnace is heated when desired. The advantage of this kind of heat is that it can be supplied only when necessary.

A clay or sandy loam is fine for potatoes. Most of the Station potatoes are grown after vetch is harvested from the land. Potatoes can be grown on thin soil, but a much larger yield can be grown from the better type of land.

An extensive fertilizer test with sweet potatoes was put on this past spring. Triplicate plots were planted. The test ranged from four hundred pounds of acid phosphate per acre to a thousand and fifty pounds of a complete fertilizer. The results were not satisfactory and will not be published. Practically the same experience was had in 1925.

Until more definite information can be secured, use about five hundred pounds of an 8-4-4 mixed fertilizer or the same amount of the following mixture: two hundred pounds acid phosphate, one hundred pounds nitrate soda, and one hundred pounds kainit, or its equivalent in some other form of potash. The past year only early plantings were satisfactory. Usually the planting made about the first of June is very satisfactory.

TABLE 18—SWEET POTATO SPACING TEST, 1925 TO 1926

PLANTED—June 10, 1926.

VARIETY—Porto Rican Yam.

PLOTS—One-twenty-third acre each, repeated three times.

Space used	Average yield in bushels			
	1924	1925	1926	Three year average
7 Inches in drill	206.2	186.6	176.8	189.9
14 Inches in drill	170.9	167.2	151.3	163.1
21 Inches in drill	154.5	151.5	147.0	151.0

Remove the vines with a hay rake, or a vine cutter may be used. In the case of a killing frost before digging, the vines should be removed within two or three days.

Two furrows with a double horse plow does good work in the absence of a potato digger. The greatest care should be used to prevent bruising. The potatoes should be assorted in the field and placed in baskets or boxes. This will facilitate handling and curing out in the curing house. It is through bruised or cut potatoes that diseases such as ring rot, storage rot, and other diseases are introduced. Such potatoes should be disposed of as soon as dug or they should be stored separately.

Get rid of excessive water in the potato. This should be done as soon as dug. The curing house is a proper place for such work. If the weather is dry, open all ventilators, doors, and windows and allow the air to circulate during the day, closing up at night. Keep fires going in furnace or stove during the day. It usually requires about two weeks to dry out a small house. The thermometer should range around eighty degrees during

the day, in order to obtain the best results in curing potatoes. Properly cured potatoes will stand four or five degrees below freezing without great damage, which is an item in marketing. The proper temperature for keeping a house during the winter is between forty-five and fifty-five degrees. Slight variations will not injure the potatoes. The sweet potato could easily be one of North Mississippi's money crops. There is a good demand on nearby markets

VETCH

Every land owner should be interested in maintaining soil fertility. The most practical way, after the surface water has been controlled, is to grow either summer or winter legumes. Red clover, bur or crimson clover, velvet or soybeans, cow peas, lespedeza or vetch are all good legumes. Take your choice, but grow a legume on your soil every year if you can. It is profitable both to the producer and to the soil. More profitable crops are grown following legumes without any additional cost. Most legumes can be grown as catch crops and in many instances cost but little more than the seeding. The hope of the South is increased production with less cost and on less acreage. This will necessitate increased soil fertility. The legume which produces well and is easily grown should be considered. Vetch is easily started on good land and if properly handled (allowed to seed once in two or three years), it will remain indefinitely on the land and come up as a volunteer crop each fall after the cultivation of ordinary crops has ended. Vetch grows some in the fall but it makes its principal growth in March, April, and early May. Hairy vetch has given the best results so far at this Station, although smooth or common vetch does well and is about ten days earlier than the hairy vetch. Vetch is not unlike other plants; it does best on good, fertile soil. It does not do well a wet season on wet land. Land on which barnyard manure has been scattered gives fine results. Use about a half pound of soil from land growing vetch successfully to each pound of seed to furnish inoculation. If let alone,

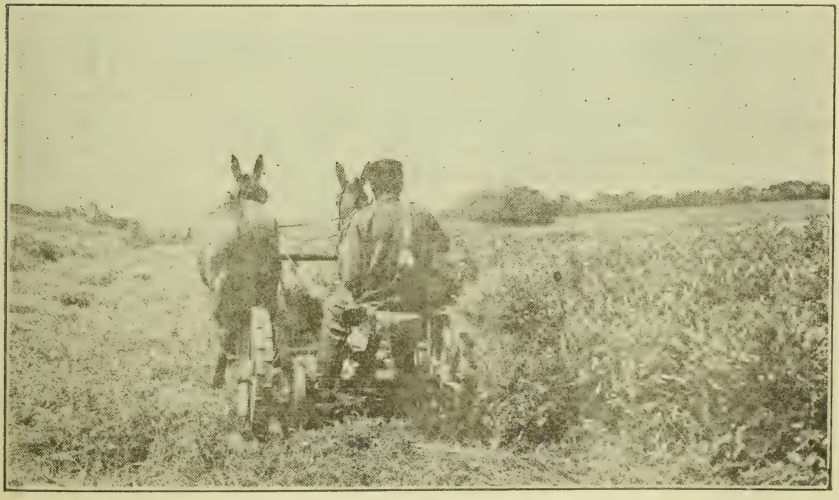


Fig. 4—Dry oats and vetch hay.

vetch will mature seed about the latter part of May. The first crop should be turned under after seeding, in order to secure a good quantity of seed for future crops. After the first year, a hay crop can be removed after some of the seed have matured.

The two year rotation method has been found to be most excellent. Plant fifteen pounds of vetch seed per acre in cotton middles in September and cover by using a cultivator of some kind. When rains begin, the vetch will germinate and do some growing during the winter. The seed will mature in June, at which time the land should be turned and planted to corn. Plant the next year to cotton and allow the vetch to mature seed, follow with corn, etc. Land treated in this way will increase in productiveness each year. A small addition of about two tons of limestone per acre will double the yield of vetch. The manure secured from stock fed on vetch hay, if scatttered on the land, will give a most excellent seeding of vetch. This is one of the easiest ways to increase the area on the farm. Land was cultivated this year which was seeded to vetch sixteen or seventeen years ago and now has a most excellent stand. Only one seeding has been made. If the season is favorable, this land will now make two bales of cotton and one hundred bushels of corn. It is necessary to keep up the supply of phosphorus and potash to get the best results following vetch. Land seeded to oats and vetch in the fall of 1925 cut three and two-tenths tons of dry hay this year and produced at least fifteen tons of silage following the oats and vetch.

Figure 3 shows cotton and sorghum in a field that has been used in the two year rotation for a number of years. This soil is getting richer each year in spite of the heavy crops removed from the land. From five hundred to eight hundred pounds of an 8-4-4 fertilizer are used on the land each year because it pays. Fertilizer is used on all crops for the same reason.

LESPEDEZA

Owing to the extreme dry summers of the past three seasons, fertilizer experiments with lespedeza have been unsatisfactory. In our reclaiming work on extremely poor soils, we found this plant the most satisfactory. It adapts itself to the soil on which it is planted from the poorest to the richest, but it is like other plants—it does best on fertile soils. The addition of phosphorus at the rate of five hundred pounds of acid phosphate per acre has doubled the yield on uplands. Many people have not fully realized what they have in this plant. Lespedeza is one of the greatest legumes ever grown in this country. If all of the idle land in Mississippi were planted to lespedeza and this crop harvested each year, it would furnish sufficient hay to feed all the live stock in the state. There is no better quality hay known. All open, idle lands should be seeded to lespedeza as a soil improver, if for no other purpose.

It is a common practice to sow fall oats, section harrow the oats the latter part of March, and seed to lespedeza, using not less than twenty-five pounds of seed per acre. After the oats are harvested, the lespedeza takes charge and produces a good crop under favorable conditions. The seed sell from three to six dollars per bushel. Many sections of the country make the growing of seed for market one of their chief money crops.

The common method of preparing land for seeding is to disk the land diagonally across the rows and run the section harrow at right angles to the disk. This will about level the land. The seed should be sown in March on freshly harrowed land and should not be covered. The weeds and grass should be clipped with a mower once or twice during the year to give the plants the advantage.

There are several machines and attachments for machines for harvesting seed on the market. A greater part of the seed on the market are secured in this way. After a light frost in the fall, the seed shatter out easily and are caught in pans attached to the machine. Seed are usually harvested from pasture land, the poorer soils, and the growth after the main crop has been cut for hay.

SOYBEANS

Laredo, Otootan, Biloxi, Virginia, Mammoth Yellow, and Wilson varieties of soybeans were planted in a variety study test. On account of unfavorable season, these plantings were not made until late and the plants failed to mature seed. The results were not satisfactory for publication.

Each of the above varieties have their place in southern agriculture. The Laredo, Otootan, and Early Virginia are very desirable varieties. The Otootan is very much later maturing than the other two varieties, but when planted early it will produce more forage per acre. If harvested at the proper time, these varieties do not shatter out very freely. This adds materially to their value. The Laredo and Virginia are desirable when hay is to be harvested before cotton picking begins. The above three varieties resemble each other in growth, have small stems, and make a fine quality hay. The Biloxi and Mammoth Yellow have a much coarser stem and are tall growing varieties. The Biloxi is very late in maturing, but does not shatter out in harvesting. The Mammoth Yellow shatters out badly in harvesting. At present it is the most widely known variety. All the above varieties are abundant fruiters.

Soybeans can be planted in narrow rows or broadcast on good fertile soil, whether grown for seed or for hay. If a three foot row is used, it only requires about one and one-half gallons of seed to plant an acre of Laredo, Otootan, Virginia, and Wilson varieties. The seed of the Biloxi and Mammoth Yellow are larger and more seed are required. Soybeans will grow on land too wet or too dry for corn. Unprofitable, wet, farm lands do well in soybeans. This fact, when put into practice, will enable thousands of acres of heretofore unprofitable lands to be made as profitable as any land on the farm. When narrow rows are used, about two cultivations are necessary. From two hundred to four hundred pounds of acid phosphate per acre should be used on the soils of this section. While all soybeans are legumes and are supposed to get a greater part of the nitrogen used from the air, it will be found that from a hundred to two hundred pounds of nitrate of soda will add much to the growth of the beans. When grown on fertile soil, the small seeded varieties have a distinctive value in that the seed that shatter out in harvesting, if disked in, will come up the following spring and produce a volunteer crop of beans. This is only true on good, fertile soil.

In many cases, oats are sown after the beans are harvested. In disking

the oats, the beans which were shatttered in harvesting are covered. After the oats are harvested in June, the volunteer beans take charge of the land and make a wonderful hay crop of three to four tons per acre.

There are several sections of the country that are growing soybeans for seed purposes. In the past the beans have been mowed and raked as for hay and then threshed. Many seed are lost in the process and it is a very expensive method. There are bean harvesters now on the market, both for single rows and for beans planted broadcast, that thresh out the beans standing in the field. This is a great labor saving process and also a saving of seed. These harvesters are mostly horse drawn and do splendid work under proper conditions. They are not very expensive, costing from a hundred and seventy-five to two hundred and fifty dollars, according to the size. This method of harvesting is very satisfactory, because only the beans are removed from the field. The plants left on the soil greatly improve the land. From fifteen to thirty bushels of beans per acre is not an uncommon yield.

If every row of corn planted in the state was seeded to soybeans, it would furnish more forage and feed and add much to the fertiliity of the soil. There are many farms too poor to grow corn successfully. On such farms, soybeans could be profitably used, taking the place of corn for the work stock in furnishing both forage and grain. Aside from vetch, most of the hay grown on the Station farm is soybeans. The Laredo bean is fine for this purpose.

BEETS

In northern Europe and eastern Canada, root crops are extensively grown for stock, but the United States has never been very enthusiastic over these crops. Root crops are especially adapted to sections having cool summers. Probably the most popular root crops grown are for live stock. The Mangel beet or stock beet and the sugar beet are grown for the production of sugar. Although these plants are low in protein, the New York Station has shown that for the dairy cow a pound of dry matter in root crops has the same feeding value, pound for pound, as dry matter in grain such as corn, wheat, etc., and that these crops could replace half the grain ration. A comparatively small acreage was set aside at the Station for testing beets as a stock feed to ascertain if they will grow in this climate and what tonnage could be expected on average soils. Unfortunately, good stands were not secured. The summer was dry and hot, but the beets made fair yields. They did not get the best cultivation and it is believed that a better yield could be obtained on first class soil and with good cultivation. The Mangel Wurzel beets gave a yield of 20,524.5 pounds per acre, and the sugar beets yielded 9,856.6 pounds per acre. These were planted April 6 and harvested on November 5. Feeding experiments will be conducted with these beets.

SAGRAIN VERSUS CORN

In an experiment, comparing sagrain with corn, replicated four times on an acreage of one-half acre, the yield of sagrain was 1891.9 pounds per acre and shelled corn was 1639.2 pounds per acre. This was planted April 16, 1926, on ordinary brown loam table land. Nine bushels of corn is equal to ten bushels of sagrain in feeding value.

DAIRYING

The Station dairy at present bids fair to be one of the best in this section of the state. A registered herd of Jersey cattle is owned by the Station. From the beginning, the dairy was recognized as necessary to furnish a market on the farm for legumes and other crops grown, and to utilize the thin lands for grazing. How this section has escaped dairying for so long a time is hard to understand. An attempt has been made to run the dairy so as not to interfere with regular Station work, leaving the experimental feature to the College herd at the A. & M. College of Mississippi. A large part of the milk is sold locally at the dairy barn and some cream is shipped on the butter fat basis. The skim milk is fed to the calves and poultry. This method interferes but little with regular farm work.

There are several projects in progress at this place to ascertain the value of cow manure measured in pounds of cotton or other crops, also a system of rotation including forage crops suited for dairy feeds, etc. The results of these projects will be reported later.

The dairy possibilities in this section are good. There is a cream and milk market within forty miles of any farm in North Mississippi. There are thousands of acres of idle land that could be made to grow feed and pasture, with but little expense. Good cows can be had in almost any section without much effort. Cream separators can be had at almost your own terms. It is advisable for most people to start the dairy with the best cows at hand and cull out the poorer ones by keeping records and purchasing good ones in their places. There is idle labor on the farm half the year that has to be fed all the year. If the idle lands of this section are ever redeemed, the dairy cow and poultry will play an important part. The richest state in the Union has dairying as her chief industry. The South has everything in her favor—mild winters, cheap lands, cheap labor, and long growing seasons. Inexpensive barns can be used. The markets are also among the best of the country. Probably with the stress of times caused by the over production of cotton, many farmers will start in the dairy business while cotton is cheap and dairy cattle high. Within a few years, there will probably be a change and then many farmers will drop the dairy business when cattle are cheap and cotton is high. Such changes appear to be unwise. Why not grow into the dairy business for keeps; it need not reduce the acreage of cotton very much.

A visit to Starkville a few days ago revealed the following condition at the Borden Milk Plant: Trucks with thirty-five or forty milk cans lined up for their turn to deliver milk to the plant, and wagons loaded with cotton during the ginning season around the best gins in the country. Every truck of milk was worth in money as much as a load of cotton at the gin. The ginning season lasts three or four months. The milk is delivered twice a day every day in the year. Any man delivering milk can tell just what he will get for each day's milk at pay day. It is not so with cotton. The two together work fine.

For the past six years, this Station has been using a milking machine that has given satisfaction. One man attends to twenty cows, milks, feeds, and maintains a sanitary dairy barn and milk house. Under ordinary conditions, a milking machine will not be necessary with cheap labor plentiful.

Any man who attempts to buy all the feed for his dairy herd will be obliged to get a high price for his milk, if he stays in business long. A silo has been found to be indispensable to the dairy business, but with plenty of velvet beans grown in corn and plenty of lespedeza and soybean hay good results can be obtained without a silo. Dairying does not mean less cotton, but more fertile land on which to grow larger crops. Bermuda grass, lespedeza, and white clover are the pasture plants for this section. A cow cannot manufacture a large quantity of milk without plenty of the right kind of material with which to do the work.

Mr. Otis B. Casanova and Mr. O. M. Ryan have assisted very materially in the success of the year's work. Mr. O. K. Morgan relieved Mr. Ryan on the first of September of this year.

Thanks are extended to Director J. R. Ricks for the kind and pleasant way in which he has directed the work.

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Report
Raymond Branch Experiment Station
1926

By

H. F. WALLACE

Mississippi Agricultural Experiment Station
A. & M. College, Mississippi
J. R. Ricks, Director

Report of the Work at the Raymond Branch Experiment Station

By H. F. Wallace

INTRODUCTION

This report contains a summary of the work conducted on the Raymond Branch Experiment Station for the year 1926. The work of previous years may be secured in three publications which cover all experiments conducted on this station since its establishment by an act of the Legislature of 1920. These publications may be secured upon request from the Mississippi Experiment Station, A. & M. College, Mississippi.

As in the past, our experiments were expressly conducted to determine the kinds and quantities of fertilizers, varieties and cultural methods of cotton, corn, legume and truck crops best suited for the southern section of the Brown Loam soil area of Mississippi. Where possible our results will show averages for various yearly periods which will always be in the last column of the tables.

The 1926 crop year was replete with alarming situations. Predictions were made early that the summer would be cold and wet and many farmers planted their cotton on well drained hillsides; then, the cotton flea was found to be the cause of great damage in some sections. Following this the boll weevil and later the army worm made their appearance. Excessive dry weather in nearly all parts of the state overcame all these fears for cotton and a very heavy yield was made. The dry weather favorable for cotton caused a very low yield of corn that had been planted late. It was evident in this section that soybeans suffered materially from drouth. One field that came under our observation fruited when about twelve inches tall. Fruit did unusually well and most early truck crops made good yields.

The past year was a very satisfactory one for this station. Good stands on fields free from grass throughout the year produced excellent yields, and some good experimental data have been secured. Much credit is due our capable farm manager, Mr. J. C. Peyton, who labored unceasingly to make this one of the best years in the short history of the Raymond Branch Experiment Station.

COTTON

Mississippi has experienced another splendid cotton year from the standpoint of production. Such good yields were obtained over the entire cotton belt, that the price received in many cases has been insufficient to cover the cost of production. The time is here to re-

duce the acreage and increase the yield, on land planted to cotton. It is evident that a poor yield is much more expensive to produce per acre than a good yield. Hence, a wise policy seems to be to make more cotton or less acres.

This may be accomplished by using seed of good varieties and the intelligent use of well balanced fertilizers. It is hardly necessary to add close spacing to the above as it seems that nearly all cotton growers have been convinced of the necessity of having a good stand of cotton.

Our experiments have been conducted along these lines for a period of years. Below may be seen the results of the past years work with twenty-five leading varieties of cotton as shown in Table 1.

TABLE 1—COTTON VARIETY TEST—1926

Variety	Pounds per acre		Lint Data			Total value per acre	Rank in value	
	Seed cotton	Lint	Percentage	Length	Cents per lb.		1926	Six year average 1921-26
Trice, Miss. Sta.	1489	500.3	33.6	1 f	12.95	74.67	16	6
Trice, Burdette	1327	467.1	35.2	15-16f	12.37	66.38	20	
Cleve.. Wan.	1163	462.9	39.8	7-8f	11.67	61.01	22	11
Cleve.. Coker	1270	491.2	38.7	7-8f	11.67	65.11	21	
Cleve. 54	1606	595.8	37.1	15-16f	12.37	83.80	10	4
Cleve., Wilson	1485	534.6	36.0	15-16	12.03	73.82	17	
Cleve., Pied.	1176	423.4	36.0	7-8f	11.67	56.94	24	9
Half & Half	1113	465.2	41.8	7-8	11.48	59.88	23	10
Cook 1010	700	296.1	42.3	7-8	11.48	38.03	25	12
Willis	1683	607.6	36.1	15-16	12.03	83.85	9	
Miller	1418	506.2	35.7	1 1-16	13.37	76.80	14	7
Acala	1341	517.6	38.6	1 f	12.95	75.26	15	8
Mexican Big Boll	1246	457.3	36.7	1 1-16	13.37	69.03	19	
D. & P. L. No. 4	1399	556.8	39.8	1 1-16	13.37	82.87	11	
D. & P. L No. 8	1475	613.6	41.6	1 1-16	13.37	90.65	6	
Deltatype Webber	1187	402.4	33.9	1 1-4f	22.37	97.86	2	5
D. & P. L. No. 5	1097	375.2	34.2	1 3-16f	17.53	72.99	18	
Delfos 631	1498	524.3	35.0	1 3-16	16.53	96.40	3	3
Delfos 910	1383	475.8	34.4	1 3-16f	17.53	92.48	4	
Delfos 911	1447	509.3	35.2	1 1-8f	15.37	87.66	8	
Delfos 6102	1495	533.7	35.7	1 1-8f	15.37	91.64	5	1
D. & P. L. No. 6	1485	564.3	38.0	1 3-16	16.53	102.49	1	
Lightning Express	1453	489.7	33.7	1 3-16	16.53	90.58	7	
Lone Star 65	1398	520.1	37.2	1 1-16f	13.78	80.45	12	2
Henderson	1467	557.5	38.0	1	12.70	79.90	13	

Recommendations:—For hill land, it has been found that Miss. Sta. Trice, Willis, Miller, D. & P. L. No. 4, Cleveland 54, and Acala are all good.

For valley land, Delfos 631, Delfos 6102, Lone Star 65, Miss. Sta. Trice, and D. & P. L. No. 6 were found to be excellent. Where a good premium is being paid for extra long staple, it may be profit-

able to grow D. & P. L. No.5 or Deltatype Webber. It should be borne in mind that these extra long stapled varieties demand good, strong valley soil. Quite satisfactory returns were secured from these long stapled varieties in this section this past season despite dry weather.

Fertilizers:—Judicious use of fertilizer has almost doubled the yield of cotton in some of our tests conducted on good valley land, and greater increases might be expected on poorer soils.

As high as 2400 pounds of a complete fertilizer per acre have been used on the station from which good profits were obtained. On plots where the nitrogen was increased to six per cent, excellent gains were made. All fertilized plots produced a profit in our test work this year.

As customary in the past, cooperative fertilizer tests were continued in 1926. All of the past years work along this line was confined to Jefferson County, on one of the farms of Judge Jeff Truly, Fayette, Mississippi. We wish to state here that Judge Truly gave every assistance in his power to add to the success of the project. Besides the general fertilizer test, a variety test and six or seven demonstration acre tests were conducted on various types of soil with varieties and fertilizers thought to be best suited to these soil types. Very satisfactory results were obtained along these lines.

Below is to be found the general fertilizer test conducted on the Station and also the cooperative fertilizer tests conducted near Fayette, Mississippi.

TABLE 2—COTTON FERTILIZER TEST, RAYMOND—1926

Pounds of Material Applied per Acre				Pounds of Seed Cotton per Acre			Dollars per Acre		
Acid Phos.	Nitrate of Soda	Sul. of Potash	Analysis	Plot Yield	Check Yield	Increase	Increase at 5c	Cost of Fert.	Net Gain
No fertilizer				1036.0	1036.0				
300	150	100	8-4-8	1570.0	1054.0	516.0	25.80	9.81	15.99
300	150	75	8-4-6	1542.0	1072.0	470.0	23.50	9.14	14.36
300	150	50	8-4-4	1515.0	1090.0	425.0	21.25	8.47	12.78
No fertilizer				1108.0	1108.0				
300	150	25	8-4-2	1541.0	1071.3	469.7	23.49	7.80	15.69
300	150	.....	8-4-0	1417.0	1034.5	382.5	19.13	7.13	12.00
300	300	50	8-8-4	1694.0	997.8	696.2	34.81	12.89	21.92
No fertilizer				961.0	961.0				
300	225	50	8-6-4	1483.0	976.0	507.0	25.35	10.68	14.67
225	150	50	6-4-4	1553.0	991.0	562.0	28.10	7.80	20.30
150	150	50	4-4-4	1430.0	1006.0	424.0	21.20	7.12	14.08
No fertilizer				1021.0	1021.0				
600	300	100	8-4-4	1667.0	1010.5	656.5	32.83	16.93	15.90
900	450	150	8-4-4	2162.0	1000.0	1162.0	58.10	25.40	32.70
1200	600	200	8-4-4	2319.0	989.5	1329.5	66.48	33.86	32.62
No fertilizer				979.0	979.0				

TABLE 3—COTTON FERTILIZER TEST, FAYETTE—1926

Pounds of Material Applied per Acre				Pounds of seed cotton per acre			Dollars per Acre		
Acid Phos.	Nitrate of Soda	Sul. of Potash	Analysis	Plot Yield	Check Yield	In-crease	Increase at 5c	Cost of Fert.	Net Gain
No fertilizer				453.0	453.0				
300	150	100	8-4-8	896.0	451.5	444.5	22.23	9.81	12.42
300	150	75	8-4-6	885.0	450.0	435.0	21.75	9.14	12.61
300	150	50	8-4-4	926.0	448.5	477.5	23.88	8.47	15.41
No Fertilizer				447.0	447.0				
300	150	25	8-4-2	915.0	456.5	458.5	22.93	7.80	15.13
300	150	.....	8-4-0	801.0	466.0	335.0	16.75	7.13	9.62
300	300	50	8-8-4	1073.0	475.5	597.5	29.88	12.89	16.99
No Fertilizer				485.0	485.0				
300	225	50	8-6-4	1128.0	537.8	590.2	29.51	10.68	18.83
225	150	50	6-4-4	958.0	590.5	367.5	18.38	7.80	10.58
150	150	50	4-4-4	996.0	643.3	352.7	17.64	7.12	10.52
No Fertilizer				696.0	696.0				
600	300	100	8-4-4	1261.0	682.0	579.0	28.95	16.93	12.02
900	450	150	8-4-4	1616.0	668.0	948.0	47.40	25.40	22.00
1200	600	200	8-4-4	1866.0	654.0	1212.0	60.60	33.86	26.74
No Fertilizer				640.0	640.0				

Remarks—The test on the Station was conducted in three series on good valley soil. Very dry weather prevailed throughout the growing season. The Fayette plots had probably a little more rain than those in the experiment station. It became necessary to poison the local plots twice for the army worm, the second application was also very effective in controlling the boll weevil. The Fayette plots were poisoned once for the army worm.

It is evident in these tests that each application of fertilizer paid cash returns after paying for the fertilizer. The work for the past two years has shown that where the nitrogen was increased to as high as six per cent in a fertilizer analysis, the profits increased accordingly. The results at this station on a two year average indicate that at least six per cent phosphorus is necessary, but we suggest the continued use of eight per cent to more fully get the benefits from nitrogen used during variable seasons. Some potash is also necessary, and for the above reason at least four per cent should be used.

Recommendations—Use five or six hundred pounds of a fertilizer carrying an 8-6-4 analysis. This may be made aproximately by using 200 pounds sixteen per cent acid phosphate, 150 pounds fifteen per cent nitrate of soda, and 100 pounds twelve per cent kainit. Any quantity may be mixed, and used at any rate per acre desired.

If this crop follows highly fertilized truck crops the year before, it may be safe to cut the phosphorus and potash to half and lower

the nitrogen to four per cent. On lands infested with coco or Johnson grass, apply only half the nitrogen and make side applications with the other half after the cotton has been chopped. Where red clay hillsides are to be used it may be advisable to leave the potash off. Fertilizer pays on fertile soil as well as on poor soil and to make "more cotton on less acres", the judicious use of fertilizer will aid to a great extent.

TABLE 4—AVERAGE RESULTS OF NITROGEN SOURCES TEST—1926

Pounds of material applied per acre	Pounds of seed cotton per acre			Per cent Increase	Two year average seed cotton increase—Pounds
	Plot Yield	Check Yield	Increase		
No nitrogen	1569.0	1569.0			
150 Nitrate soda	2005.0	1621.3	383.7	23.67	351.6
112.5 Sulphate ammonia	1942.0	1673.5	268.5	16.04	269.6
86.5 Leunasaltpeter	2116.0	1725.8	390.2	22.61	.....
No nitrogen	1778.0	1778.0			
107 Calcium Cyanamid	1763.0	1721.3	41.7	2.42	193.4
150 Calcium nitrate	1913.0	1664.5	248.5	14.93	285.3
48.9 Urea	1839.0	1607.8	231.2	14.38	298.1
No nitrogen	1551.0	1551.0			

Remarks—Quite a bit of attention has been given to finding the best nitrogen fertilizer to use in mixing fertilizers. In this connection only the results given in Table 4 are submitted. As will be observed, Leunasaltpeter was only used in 1926 and could not be included in the two year average. This work was conducted in three series and all applications were based on twenty-two and one-half pounds of actual nitrogen per acre, or expressing it in nitrate of soda, 150 pounds would be required per acre. It appears that several new sources are promising.

Potash Sources—Some work was also done with sources of potash under cotton this past year. At present only one years work has been conducted with kainit, sulphate of potash, and muriate of potash. Kainit contains twelve pounds of actual potash, while sulphate and muriate of potash contain approximately fifty and forty-eight pounds, respectively, of actual potash to every one hundred pounds. More work must be done with sources of potash before any recommendations can be made.

TABLE 5—COTTON SPACING TEST—1926

Number of stalks		Yield seed cotton pounds per acre	Rank in production
Plot	Foot		
339	.68	1810.0	5
636	1.28	1898.3	4
839	1.68	1975.8	3
1118	2.25	2077.0	2
1141	2.29	2142.5	1

Remarks—It is our opinion that close spacing along with good cotton years and judicious use of fertilizers and varieties has been responsible for the over-production of cotton. The above table, like tables in the past, reveals the fact that where the number of stalks per foot is increased, then follows an increased yield of seed cotton. Quick maturing, medium sized, small leaf varieties will stand closer spacing in the drill than the slow growing, large leaf varieties. The poorer classes of soil will stand closer spacing than the fertile valley soils.

The above test was conducted in four series with Lone Star 65 cotton and fertilized with five hundred pounds of an 8-5-4 fertilizer. Two applications of calcium arsenate were made to combat the army worm and the boll weevil.

Conclusions—This test, along with results in the past, indicate leaving two to three stalks per foot, using three and one-half foot rows on valley land. On hill land, use three foot rows and leave three to five stalks per foot in bunches. More cotton can be made on fewer acres by the proper use of fertilizer, good varieties, practical cultural methods, and close spacing as recommended above.

CORN

Mississippi has reached the point where the "live at home" program must be practiced. We must raise enough food and feed to supply the farm needs, before we can raise cash crops successfully.

The work here has been conducted along these lines by conducting variety, fertilizer, and nitrogen sources tests with corn. Very good results were obtained this past year although practically all of our corn was made with very little rain. All corn plots were located on valley land, however.

Below may be seen the results of the variety work with corn in Table 6.

TABLE 6—CORN VARIETY TEST—1926

Variety	Yield shelled corn Bus. per acre	Per cent of grain	Rank 1926	Average bus, 1922-26	Average rank 1922-26
Mosby, Station	39.27	78.9	5	30.01	7
Mosby, Delta	37.96	77.9	9	30.36	5
Mosby, Lee	32.23	83.2	19		
Mosby, Suttle	36.83	80.7	11		
Cocke's Prol., Station	40.45	80.0	2	31.58	2
Cocke's Prol., Delta	36.75	75.8	12	29.71	9
Hastings	39.00	78.7	7	29.05	10
Johnson's Prol.	40.15	78.7	3		
Delta Prolific	36.59	77.3	13		
Mexican June	39.19	75.6	6	30.67	4
Laguna	42.87	80.9	1	33.91	1
Ellis	37.07	75.7	10	30.32	6
Paymaster, Neal	36.18	78.0	14	29.78	8
Paymaster, Fisher	40.15	78.6	3		
Yellow Dent, Ferg.	32.44	78.3	18		
Yellow Dent, Sta.	37.98	78.2	8		
Golden Dent, Ulla.	35.03	75.1	17		
Golden Dent, Sta.	35.23	76.4	16		
Whatley's Pro., Raym'd.	36.11	74.4	15	31.52	3

Remarks—The above test was planted around the middle of May in six series on a well prepared seed bed. A mixture of 100 pounds of acid phosphate, 200 pounds of nitrate of soda, and 50 pounds of kainit was applied per acre. Good stands were secured but excessive dry weather reduced the yield. It will be observed that the 1926 results are given in full and in the last two columns a five year average has been compiled with ten varieties. Attention is called to the fact that out of nineteen leading varieties, there was a difference of 10.64 bushels per acre in the leader and the last variety. The table speaks for itself, but care should be taken in selecting varieties as to the size of ear as some farmers desire very large eared varieties.

For very late planting, Mexican June and Laguna will probably give the best results.

TABLE 7—CORN FERTILIZER TEST, Raymond—1926

Pounds of material applied per acre			Analysis	Bushels of corn per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash		Plot yield	Check yield	Increase	Increase at $1.00	Cost of fert.	Net gain
No fertilizer				11.90	11.90				
300	150	100	8-4-8	22.00	11.43	10.57	10.57	9.81	.76
300	150	75	8-4-6	22.90	10.95	11.95	11.95	9.14	2.81
300	150	50	8-4-4	21.40	10.48	10.92	10.92	8.47	2.45
No fertilizer				10.00	10.00				
300	150	25	8-4-2	23.80	11.33	12.47	12.47	7.80	4.67
300	150	....	8-4-0	27.00	12.65	14.35	14.35	7.13	7.22
300	300	50	8-8-4	32.80	13.98	18.82	18.82	12.89	5.93
No fertilizer				15.30	15.30				
300	225	50	8-6-4	32.80	15.90	16.90	16.90	10.68	6.22
225	150	50	6-4-4	30.20	16.50	13.70	13.70	7.80	5.90
150	150	50	4-4-4	30.40	17.10	13.30	13.30	7.12	6.18
No fertilizer				17.70	17.70				

TABLE 8—NITROGEN SOURCE TEST WITH CORN, RAYMOND—1926

Pounds of materials	Bushels ear corn per acre			Per cent increase
	Plot yield	Check yield	Increase	
No nitrogen	36.2	36.2		
150 Nitrate soda	52.3	35.8	16.5	46.1
112.5 Sulphate ammonia	42.8	35.4	7.4	20.9
86.5 Leunasaltpeter	43.4	35.0	8.4	24.0
No nitrogen	34.6	34.6		
105 Calcium cyanamid	40.5	33.7	6.8	20.2
150 Calcium nitrate	48.8	32.8	16.0	48.8
48.9 Urea	45.0	31.8	13.2	41.5
No nitrogen	30.9	30.9		

Remarks—In fertilizing corn, one is compelled to be careful not to use more fertilizer than will show a profit. Corn does not require the fertilizer that is often used with cotton. Satisfactory yields are obtained more often from corn without fertilizer than from cotton without fertilizer, due to the fact that a farmer knows that he cannot grow corn on poor land successfully and for that reason puts it on his bottom land. In too many cases it is forgotten after being worked out and all attention given to cotton and it is surprising to see that a fair yield is obtained even though it is left to "grow wild".

General fertilizer work at this station has given good results and promising sources of nitrogen have been tested. A change is to be made in the general fertilizer work to more nearly conform with the fertilizer needs.

Recommendations—For general use, a mixture of 100 pounds of

acid phosphate, 150 pounds of nitrate of soda, and 50 pounds of kainit per acre will probably cover our requirements on corn land. Where good farming and frequent cultivation is to be done, from 50 to 100 pounds of nitrate of soda or sulphate of ammonia, or the equivalent in equal pounds of nitrogen from some other quick acting source might be profitably used as a side dressing. This side dressing should be applied when the corn is about knee high, just after a good rain if possible.

It might be stated here that any equivalent form of potash may also be used in the place of kainit, provided the price justifies.

SOYBEANS

A test was conducted to determine the amount of hay, as well as the yield of grain, per acre of some of the leading varieties of soybeans. These beans followed a crop of crimson clover and were planted around the first of June. Dry weather prevailed and a poor stand resulted. Replanting of skips followed around the last of June and as the dry weather continued, a poor stand was secured.

The results from this test could not be considered accurate, but it might be stated that the Virginia matured two weeks earlier than the Laredo and three weeks earlier than the Mammoth Yellow. The Laredo produced more hay than either of the other two and did not shatter as badly when cut. The Otootan is a very desirable bean and makes a splendid bean to grow with corn. It will produce as much and probably more hay per acre than the Laredo but on account of maturing three or four weeks later it must be harvested at a time when cotton picking should be done. The Biloxi and Mammoth Yellow beans have course main stems and stock will often leave this portion of the plant unless it is made into a ground feed. All these beans are excellent soil builders of the summer legume class and every row of corn in Mississippi should be planted in soybeans also. They work well in a two year rotation with cotton, vetch, corn and soybeans.

TOMATOES

The trucking section of Mississippi has been taken into consideration by this Station and due to the importance of the tomato, it has been given quite a bit of attention. Various tests have been conducted as to varieties, sources of nitrogen, sources of potash, and to determine the best formulae in producing tomatoes. These tests follow in tabular form.

TABLE 9—TOMATO VARIETY TEST—1926

Variety	Yield in pounds per acre		Percentage picked early		Percent of shippers	Average size of shippers lb.
	Total	Shipping tomatoes	Total	Shipping tomatoes		
Globe	6830	3127	47.6	30.0	45.8	.280
Gulf States	9552	5543	37.7	33.3	58.0	.254
Detroit	7830	4608	43.0	39.6	58.8	.258
Marglobe—Red	7870	4443	45.5	45.1	56.5	.286
Marvel	6204	2608	32.2	22.2	42.1	.238
Norton—Pink	7455	3742	40.6	34.9	50.2	.272
Richards	8696	4474	46.4	41.3	51.5	.268
Burpee—1099	6029	2062	52.1	32.9	34.2	.273

Remarks—Seed were planted in the hotbed January 19, 1926. The plants were set in the field March 4 and skips reset March 9. Poisoned bait was used over the entire field and cutworms were controlled practically one hundred per cent. The above test was in three series.

Conclusions—The Gulf States Market on the three year average has been the heaviest yielder but it must be noted that the fruit is smaller than the Globe or Detroit or the wilt resistant Marglobe and Norton-Pink. The latter two, along with Marvel, are good varieties to plant on wilt infested soil. Many growers get good packs by mixing Globe and Gulf States when planting in the hotbed as the Gulf States, being smaller, will fill in the basket and help eliminate "shake". A check of the field showed practically no wilt in Marglobe.

TABLE 10—ANALYSIS TEST WITH TOMATOES—1926

Analysis	Pounds per acre		Percent. shippers	Per cent picked early		Dollars per acre		
	Total	Shippers		Total	Shippers	Total value at 6c	Cost of fert.	Net gain
			(1500 pounds per acre)					
10-3-3	9783	4114	42.0	36.2	31.1	246.81	19.74	227.07
8-3-3	10964	5542	50.5	38.3	27.9	332.49	18.05	314.44
8-4-3	12206	5979	48.9	37.8	26.6	358.74	21.01	337.73
8-5-3	11269	6657	59.0	31.5	15.4	399.39	23.96	375.43
			(2000 pounds per acre)					
10-3-3	11833	6689	56.5	34.4	25.3	401.34	26.32	375.02
8-3-3	12456	7250	58.2	38.2	32.7	434.97	24.07	410.90
8-4-3	10308	5282	51.2	25.5	17.9	301.69	28.01	273.68
8-5-3	12169	6519	53.5	30.0	25.8	391.11	31.95	359.16

Remarks—The analysis test was conducted to determine the fertilizer analysis best suited to producing tomatoes economically. This work has not advanced enough to make any definite conclusions. The test was conducted in two series. All nitrogen was derived from equal pounds of nitrogen from nitrate of soda, sulphate of ammonia, and cottonseed meal. Potash was derived from sulphate of potash.

TABLE 11—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH TOMATOES—1924, 1925 and 1926

Source of Nitrogen	Pounds per acre		Per cent shippers	Per cent picked early		Total value dollars
	Total	Shippers		Total	Shippers	
	(1500 pounds of an 8-4-3 per acre)					
Nitrate of soda	9536	4417	47.2	41.3	56.2	274.01
Ammonium sulphate	9216	4139	44.5	48.9	58.4	257.34
Combination	8987	4333	48.2	41.6	49.7	268.79
Urea	8916	4385	49.3	44.8	51.3	271.40
Cottonseed meal	9095	4286	47.4	43.5	51.2	266.95
	(2000 pounds of an 8-4-3 per acre)					
Nitrate of soda	9611	4309	46.5	45.7	54.4	269.29
Ammonium sulphate	9085	4163	47.3	48.8	56.5	259.42
Combination	10930	4913	46.5	47.0	55.2	306.95
Urea	10100	5098	51.1	45.8	52.8	315.52
Cottonseed meal	10063	4830	49.2	41.2	48.3	300.69

Remarks—The above test was conducted to determine the best source of nitrogen to use in a fertilizer formula for producing tomatoes commercially. Where a combination is listed it means the nitrogen was derived from equal pounds of nitrogen from nitrate of soda, sulphate of ammonia, and cottonseed meal. The other nitrogen was derived from sources indicated. Phosphorus from acid phosphate and potash from sulphate of potash.

There are several promising sources and, at present, the limiting data seems to slightly favor Urea, with others closely following. More work will have to be done to make any definite recommendations. This work was conducted in three series and was handled as stated in the variety work. The Globe variety was used in this test.

TABLE 12—AVERAGE RESULTS OF POTASH TESTS WITH TOMATOES—1924 1925 and 1926

Analysis	Pounds per acre		Per cent shippers	Per cent picked early		Dollars per acre		
	Total	Shippers		Total	Shippers	Total value	Cost of fert.	Net gain
	(1000 pounds per acre)							
8-4-0	13321	6326	48.5	38.6	47.3	393.10	10.14	382.96
8-4-3	13564	6035	45.2	42.0	45.8	376.61	12.00	364.61
8-4-6	13963	6111	44.3	46.6	47.6	382.07	13.56	368.51
	(1500 pounds per acre)							
8-4-0	14118	6419	46.2	43.5	49.3	400.02	15.66	384.36
8-4-3	12285	5567	46.7	49.5	40.7	347.90	18.00	329.64
8-4-6	13112	6999	52.9	41.1	43.7	429.51	19.51	410.22
	(2000 pounds per acre)							
8-4-0	13625	6279	47.2	39.1	44.2	391.34	20.88	370.46
8-4-3	13548	6355	47.3	47.6	47.1	394.74	24.00	370.74
8-4-6	13387	6069	45.6	39.9	42.6	377.96	27.12	350.84

Remarks—Like the preceding table, the above data represents a three year average. The motive in this test is to determine the most economical amount of potash to use in growing tomatoes. Sulphate of potash was used in all formulas, nitrogen was derived from the above mentioned combination and phosphorus from acid phosphate. This test covered four series this past year.

From varying amounts and indications, it is felt safe to state that some potash is necessary and three per cent is suggested, as the availability of the nitrogen and phosphorus to get best results might depend on some potash. From observation, a more stockily built plant results from the use of some potash.

TABLE 13—AVERAGE RESULTS OF ENGLISH PEA FERTILIZER TEST—1924, 1925 and 1926

Fertilizer analysis	Yield per acre, pounds	Value at 5c	Cost of fertilizer	Net gain
	(1000 pounds per acre)			
10-3-3	3693	179.65	11.59	168.06
8-3-3	2811	140.55	10.49	130.06
8-4-3	2774	138.70	12.00	126.70
	(1500 pounds per acre)			
10-3-3	3185	159.25	17.39	141.86
8-3-3	3367	168.35	15.74	152.61
8-4-3	3100	155.00	18.00	137.00

TABLE 14—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH ENGLISH PEAS—1924-25-26

Rate per acre of 8-4-3, pounds	Yield using nitrate soda, pounds	Yield using ammonium sulphate, pounds
1000	4182	4106
1500	4028	4290

Remarks—Tables 13 and 14 represent a fertilizer test to determine the best analysis and the source of nitrogen to use in growing English or green peas for the market. These tests were conducted in two series and the Alaska and Gradis peas were used. All nitrogen was derived from the above mentioned combination. The tables show a three year average and indications point toward 1000 pounds per acre of a 10-3-3 and in the nitrogen test slightly in favor of sulphate of ammonia, however, this seems slightly immaterial. Further information along these lines will be published in the future.

TABLE 15—AVERAGE RESULTS OF SNAP BEAN FERTILIZER TEST—1924, 1925 and 1926

Fertilizer analysis	Yield per acre, lb.	Value at 5c	Cost of fertilizer	Net gain
		(1000 pounds per acre)		
10-3-3	4131	206.55	11.59	194.96
8-3-3	3663	183.15	10.49	172.66
8-4-3	3564	178.20	12.00	166.20
		(1500 pounds per acre)		
10-3-3	3745	187.25	17.39	169.86
8-3-3	3597	179.85	15.74	164.11
8-4-3	3880	194.00	18.00	176.00

TABLE 16—AVERAGE RESULTS OF NITROGEN SOURCES TEST WITH SNAP BEANS—1924-25-26

Rate per acre of an 8-4-3 pounds	Yield using nitrate soda, pounds	Yield using Ammonium sulphate, pounds
1000	3632	3714
1500	4186	4441

Remarks—The above tables represent three years work with snap or green beans. The combination was used in securing nitrogen in Table 15, while in Table 16 the nitrogen was derived as indicated. The Red Valentine variety was used.

Indications point toward 1000 pounds of a 10-3-3 and the three year average is in favor of using sulphate of ammonia. This work will be continued in the future.

GENERAL WORK

Rotations—It is our policy to grow a legume on all lands at least once a year. Several rotations are under way and outstanding among these is the two year rotation with cotton, vetch, corn and soybeans. This gives a legume on the land summer and winter and does not interfere materially with either crop.

To start this, at the last cultivation of cotton, sow seventeen to twenty pounds of vetch seed to the acre. This germinates in the fall and matures seed around the middle of May and the first year must be turned under to insure a volunteer crop the following fall. After turning under, plant the land to corn and soybeans. As stated, the vetch volunteers and in the spring may be turned under or cut for hay as desired and then planted to cotton. Permit vetch to mature seed every other year and be insured of a volunteer stand every year.

In this connection, bur clover will also reseed itself and may be used in a similar rotation.

Legumes—Much benefit has been derived from using bur clover, vetch, and crimson clover as winter legumes. Crimson clover is an annual and must be planted each year. As stated above, vetch and bur clover will reseed themselves if permitted to mature seed once every two years.

Soybeans, velvet beans, peas, and lespedeza comprise the best summer legumes for this section. Lespedeza reseeds, while the others must be planted each year. These legumes fit into rotations nicely and are recognized as excellent soil builders.

Orchards—A nice young orchard has been started and results show that with a little attention given to prunning, spraying and cultivation, anyone can produce excellent fruit in this section. Vetch grows profusely in our orchard and contributes liberally toward the fertilizing program for the trees. This vetch was started four years ago and volunteers each year.

Boll Weevil Work—Hibernation and emergence work along this line has been done in connection with the State Plant Board. There are at present five cages of six hundred weevil each located on the station. These cages are watched daily throughout the emergence period and records are kept to determine the percentage of emergence during the season. Several cotton states are doing this work.

Irish Potatoes—Much work has been done with certified seed against uncertified seed in Irish potato work. Some very promising results were obtained by the State Plant Board in cooperation with the Station along these lines in 1925. Dry weather and poor stands caused such irregularity in 1926 that the results were not worth publishing. This work will be continued in 1927.

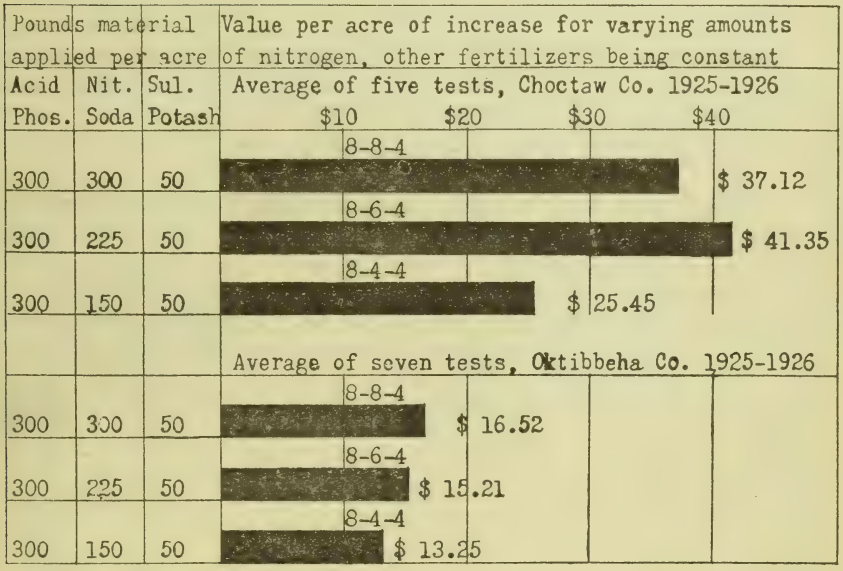
Improvements—Many improvements have been made on the Station during the past year. A new bungalow has been erected for the farm manager and also a new tenant house constructed. The barn has been covered with a new galvanized roof. Extensive repairs have been made on fences and an electric line extended to the Station residence. Landscaping has come in for its share of attention.

Conclusion—A successful years work has come to a close. We wish to express appreciation to Dr. B. M. Walker, President of A. & M. College, and to Director J. R. Ricks of the Experiment Station for the kind and business-like manner in which they have directed the work of the Raymond Branch Experiment Station.

COTTON

FERTILIZERS AND VARIETIES

CENTRAL STATION
1926



MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. College. Mississippi
J. R. RICKS, Director

RECOMMENDATIONS

For east central Mississippi soils the general recommendation is 600 pounds per acre of an 8-6-0 analysis fertilizer. A deviation from this should be made as follows:

This amount should be increased where conditions are favorable and on many worn soils, especially of the clay hill section.

Reduce the amount per acre on soils that are naturally fertile.

Add 4% potash to this mixture where cotton rusts or shows leaf disease, where soil has been cropped for a long period of time, and where more than 600 pounds of the mixture is to be used.

Change analysis to 8-8-0 on prairie soils.

Change analysis to 8-4-0 on soils where legumes have been turned under.

Factory mixed fertilizer of the desired analysis and containing readily soluble source of nitrogen may be used. The equivalent of the applications recommended above may be obtained by mixing and applying the following combinations of materials per acre: For 8% phosphoric acid use 300 pounds, 16% acid phosphate. For 6% nitrogen use 240 pounds nitrate of soda or 180 pounds sulphate of ammonia, or a combination of one-half of either with 275 pounds cottonseed meal. For 8% nitrogen use 320 pounds nitrate of soda or 220 pounds sulphate of ammonia, or a combination of one-half of either with 365 pounds cottonseed meal. For 4% potash use 50 pounds muriate of potash, 48 pounds sulphate of potash, or 200 pounds, 12% kainit.

COTTON FERTILIZERS AND VARIETIES

By

J. F. O'Kelly, C. B. Anders, and W. W. Hull

FERTILIZERS

The same lines of investigation as reported in Bulletin 230 have been continued and expanded. The work in 1926 consisted of sixty series located on fifteen individual farms. Soil types used included the sand clay hills of northeast Mississippi, the flatwoods, and both red and black prairie soils.

These tests have been conducted under actual farm conditions. Such factors as variety of seed, cultural operations, etc. are left entirely with the farmer. The results obtained should thus be applicable to average farm conditions. In each case care was taken to see that grass and weeds were kept under control and that the plots were not otherwise neglected. Similar results could not be expected where, due to over-cropping or shiftlessness, the crop is neglected.

In this work all measurements, weights, applications, and pickings were made either by a member of the Station staff or under his direct observations.

In computing the results for 1926 the unusually low price of five cents per pound for seed cotton was used in reducing the pounds increase from each fertilizer application to dollars per acre. Due to weather conditions and insect injury, yields were even below normal in some instances. With the cost of fertilizer about the same as 1925, the net gain this year is probably below what could be expected.

These variations in the value of seed cotton and the cost of fertilizer introduce a constantly changing factor into the net gain indicated. The expected increase will vary with the total yield and this will depend on climatic conditions, variety, cultural practice, etc. However, the relative increases from various fertilizer applications should be constant. The comparative efficiency of a fertilizer should be measured by these increases. The practical application can be based on this efficiency but influenced by the prevailing cost of fertilizer and market price of the product.

Methods—In this work a test consists of the series of plots as outlined in the tables, repeated three or four times on a single farm. Unfertilized, or check plots, are placed at the beginning of each series and repeated every third or fourth plot.

Calculations are made according to methods adopted by the American Society of Agronomy Vol. 16—No. 1. In all tables the column headed "Plot yield" indicates actual yield obtained. The column headed "Check yield" gives the actual yield of all check plots and for the treated plots a calcu-

lated yield without treatment based on the assumption that the soil varies uniformly between untreated, or check plots. The check yields are thus the normal yield of the soil under given conditions and the increase is obtained by subtracting this check yield of each plot from the actual yield. The increase thus obtained is placed in the column headed "Increase". It is a measure of the gain or loss due to the treatment indicated.

The column headed "Analysis" in Tables 1 to 8 indicates the nearest analysis in whole numbers to the actual analysis of the mixture used. In these tables the materials applied to the last three fertilized plots supply approximately as much plant food to the acre as would be supplied by 1200, 1800 and 2400 pounds respectively of an 8-4-4 mixed fertilizer. All other treatments are based on 600 pounds of mixed fertilizer of the analysis indicated.

TABLE 1—AVERAGE TWO TESTS, CHOCTAW COUNTY—1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer				284.62	284.62	—	—	—	—
300	150	100	8-4-8	1032.15	307.87	724.30	36.21	9.01	27.20
300	150	75	8-4-6	1066.47	331.12	735.35	36.77	8.54	28.22
300	150	50	8-4-4	1114.82	354.35	760.45	38.02	8.07	29.95
No fertilizer				377.60	377.60	—	—	—	—
300	150	25	8-4-2	1239.17	377.31	861.85	43.09	7.60	35.49
300	150	—	8-4-0	1147.07	377.02	770.05	38.50	7.13	31.37
300	300	50	8-8-4	1481.42	376.73	1104.70	55.23	12.49	42.74
No fertilizer				376.45	376.45	—	—	—	—
No fertilizer				354.45	354.45	—	—	—	—
300	225	50	8-6-4	1413.17	343.19	1070.00	53.50	10.28	43.22
225	150	50	6-4-4	1163.85	331.93	831.90	41.59	7.40	34.19
150	150	50	4-4-4	1110.97	320.68	790.30	39.51	6.72	32.79
No fertilizer				309.42	309.42	—	—	—	—
600	300	100	8-4-4	1423.07	302.42	1120.65	56.03	16.13	39.90
900	450	150	8-4-4	1593.65	295.51	1298.15	64.90	24.20	40.70
1200	600	200	8-4-4	1579.95	288.53	1291.42	64.57	32.26	32.30
No fertilizer				281.60	281.60				

A study of these tables will bring out four distinct groups of plots. Group one, consisting of the first five fertilized plots, shows a variation from no potash to 8%, phosphorus and nitrogen being held constant at 8% and 4% respectively. In group two, fertilized plots 3, 6, and 7, nitrogen is varied from 4% to 8%, while phosphorus and potash are constant. Group three, fertilized plots 3, 8, and 9, shows a variation from 4% to 8% of phosphorus, the other elements being constant. In the fourth group, plots 3, 10, 11, and 12, amounts of an 8-4-4 fertilizer are varied from 600 to 2400 pounds per acre.

Results in (1) Choctaw County in 1926 differed very little from those of 1925. These, and the average results for both years, are reported in Tables 1 and 2.

(1) These tests conducted in cooperation with J. B. Ray and Clyde Coleman.

TABLE 2—AVERAGE FIVE TESTS, CHOCTAW COUNTY—1925 AND 1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer				564.11	564.11	—	—	—	—
300	150	100	8-4-8	1183.82	575.73	608.09	35.32	9.14	26.18
300	150	75	8-4-6	1199.88	587.36	612.52	35.52	8.59	26.92
300	150	50	8-4-4	1186.11	598.97	587.12	33.49	8.04	25.45
No fertilizer				610.6	610.6	—	—	—	—
300	150	25	8-4-2	1263.23	610.45	652.78	37.07	7.50	29.57
300	150	—	8-4-0	1210.28	610.31	599.97	34.29	6.85	27.34
300	300	50	8-8-4	1474.26	610.16	864.10	49.44	12.31	37.12
No fertilizer				610.02	610.02	—	—	—	—
No fertilizer				599.02	599.02	—	—	—	—
300	225	50	8-6-4	1482.43	593.39	889.05	51.53	10.18	41.35
225	150	50	6-4-4	1275.02	587.76	687.25	39.78	7.38	32.40
150	150	50	4-4-4	1204.33	582.14	622.2	35.65	6.71	28.94
No fertilizer				576.51	576.51	—	—	—	—
No fertilizer				602.51	602.51	—	—	—	—
600	300	100	8-4-4	1528.53	599.01	929.52	53.86	16.08	37.77
900	450	150	8-4-4	1715.92	595.55	1120.37	65.44	24.13	41.31
1200	600	200	8-4-4	1748.12	592.06	1156.06	68.01	32.17	35.83
No fertilizer				588.60	588.60	—	—	—	—

Table 2 indicates that the addition of potash to 600 pounds of an 8-4-0 mixture, where rust is not present, is not profitable on the sand clay soils of this section. Increased amounts of nitrogen pay well, 6% being somewhat more profitable than 8%, and a great deal more profitable than 4%. The indications are that the ratio of nitrogen to phosphoric acid should be the same.

In all Webster and Choctaw County tests excellent net gains have been made from amounts greater than 600 pounds of an 8-4-4 mixture. These results however, have not been materially greater than those from 600 pounds of an 8-8-4 or an 8-6-4 mixture.

TABLE 3—AVERAGE TWO TESTS, WEBSTER COUNTY—1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Increase at 5c	Cost of fert.	Net gain
No fertilizer				698.25	698.25	—	—	—	—
300	150	100	8-4-8	1179.50	673.35	506.15	25.31	9.01	16.30
300	150	75	8-4-6	1149.88	648.44	501.44	25.07	8.54	16.53
300	150	50	8-4-4	1116.25	623.54	492.71	24.64	8.07	16.57
No fertilizer				598.63	598.63	—	—	—	—
300	150	25	8-4-2	1078.63	608.38	470.25	23.51	7.60	15.91
300	150	—	8-4-0	1067.38	618.13	449.25	22.46	7.13	15.33
300	300	50	8-8-4	1255.88	627.88	628.00	31.40	12.49	18.91
No fertilizer				637.63	637.63	—	—	—	—
300	225	50	8-6-4	1208.63	632.41	576.22	28.81	10.28	18.53
225	150	50	6-4-4	1115.00	627.19	487.81	24.39	7.40	16.99
150	150	50	4-4-4	1049.50	621.97	427.53	21.38	6.72	14.66
No fertilizer				616.75	616.75	—	—	—	—
600	300	100	8-4-4	1304.50	640.85	663.65	33.18	16.13	17.05
900	450	150	8-4-4	1439.88	664.94	774.94	38.75	24.20	14.55
1200	600	200	8-4-4	1480.13	689.04	791.09	39.55	32.26	7.29
No fertilizer				713.13	713.13	—	—	—	—

Tests in [2] Webster County, Table 3, indicate a small profit from the use of 4% of potash. As in the Choctaw County tests, these soils gave the greatest net gain from equal parts phosphoric acid and nitrogen.

TABLE 4—AVERAGE FIVE TESTS, OKTIBBEHA COUNTY—1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer				406.7	406.7	—	—	—	—
300	150	100	8-4-8	815.9	384.43	431.47	21.57	9.01	12.56
300	150	75	8-4-6	723.70	362.15	361.55	18.08	8.54	9.54
300	150	50	8-4-4	696.90	339.88	357.02	17.85	8.07	9.78
No fertilizer				317.60	317.60	—	—	—	—
300	150	25	8-4-2	668.85	311.41	357.44	17.87	7.60	10.27
300	150	—	8-4-0	624.00	305.23	318.77	15.94	7.13	8.81
300	300	50	8-8-4	786.85	299.04	487.81	24.39	12.49	11.90
No fertilzer				292.85	292.85	—	—	—	—
No fertilizer				305.05	305.05	—	—	—	—
300	225	50	8-6-4	715.00	306.01	408.99	20.45	10.28	10.17
225	150	50	6-4-4	629.80	306.98	322.82	16.14	7.40	8.74
150	150	50	4-4-4	602.80	307.94	294.86	14.74	6.72	8.02
No fertilizer				308.90	308.90	—	—	—	—
600	300	100	8-4-4	851.60	316.43	535.17	26.76	16.13	10.63
900	450	150	8-4-4	865.50	323.95	541.55	27.08	24.20	2.88
1200	600	200	8-4-4	889.75	331.48	558.27	27.91	32.26	—4.35
No fertilizer				339.00	339.00	—	—	—	—

Five tests were conducted in [3] Oktibbeha County on flatwoods soil, flatwoods merging into sandy, and flatwoods merging into Houston clay. These results are reported in Table 4. The average results for 1925 and 1926 in this county are reported in Table 5. In these tests returns from the use of potash have been indicated in spots. The two year average would lead us to expect a profitable return from 2% to 4% potash in the mixture, when used on most of these soils.

TABLE 5—AVERAGE SEVEN TESTS, OKTIBBEHA COUNTY—1925 AND 1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Mur. of potash		Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer				470.35	470.35	—	—	—	—
300	150	100	8-4-8	846.60	459.21	387.39	22.80	9.14	13.66
300	150	75	8-4-6	850.85	448.08	402.77	24.58	8.60	15.98
300	150	50	8-4-4	792.15	436.94	355.21	21.30	8.05	13.25
No fertilizer				425.80	425.80	—	—	—	–
300	150	25	8-4-2	741.98	422.71	319.27	18.78	7.50	11.28
300	150	—	8-4-0	623.15	419.62	203.53	11.06	6.95	4.11
300	300	50	8-8-4	898.23	416.52	481.71	28.84	12.32	16.52
No fertilizer				413.43	413.43	—	—	—	—
No fertilizer				419.53	419.53	—	—	—	—
300	225	50	8-6-4	841.15	420.01	421.14	25.39	10.18	15.21
225	150	50	6-4-4	750.30	420.49	329.81	19.86	7.38	12.48
150	150	50	4-4-4	696.90	420.97	275.93	16.37	6.71	9.66
No fertilizer				421.45	421.45	—	—	—	—
600	300	100	8-4-4	1085.40	425.21	660.19	40.86	16.09	24.77
900	450	150	8-4-4	1091.80	428.98	662.82	40.99	24.13	16.86
1200	600	200	8-4-4	1075.98	432.74	643.24	39.44	32.17	7.27
No fertilizer				436.50	436.50	—	—	—	—

(2) These tests conducted in cooperation with J. B. Hardee and C. F. Ferguson.
(3) These tests were located on Station farm and in cooperation with Jim Cummins, Thos. Wofford, W. C. Butler, and Grafton Yeates.

A ratio of phosphoric acid to nitrogen of 8% to 8%, or at least 8% to 6% is clearly indicated in these tests.

In 1925 applications heavier than 600 pounds per acre gave the most profitable returns. Because of unfavorable weather conditions and insect injury, yields were relatively low in this section in 1926 and applications greater than 1200 pounds per acre resulted in a net loss in many instances. Twelve hundred pounds per acre, however, yielded a large net gain and with normal yields and higher prices for seed cotton, amounts greater than 600 pounds should be very profitable.

TABLE 6—AVERAGE TWO TESTS, PRAIRIE SOIL—1926

Pounds of material applied per acre			Analysis	Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash		Plot yield	Check yield	Increase	Increase at 5c	Cost of fert.	Net gain
No fertilizer				649.12	649.12	—	—	—	—
300	150	100	8-4-8	995.62	642.40	353.22	17.66	9.81	7.85
300	150	75	8-4-6	964.12	635.67	328.45	16.42	9.14	7.28
300	150	50	8-4-4	954.37	627.22	327.15	16.35	8.47	7.88
No fertilizer				621.37	621.37	—	—	—	—
300	150	25	8-4-2	999.75	619.65	380.1	19.00	7.80	11.20
300	150	—	8-4-0	958.87	616.70	342.17	17.10	7.13	9.97
300	300	50	8-8-4	1192.75	613.61	579.13	28.96	12.89	16.07
No fertilizer				610.50	610.50	—	—	—	—
300	225	50	8-6-4	1088.62	599.90	488.72	24.43	10.68	13.75
225	150	50	6-4-4	1001.25	589.31	411.94	20.60	7.80	12.80
150	150	50	4-4-4	971.62	578.71	392.91	19.64	7.12	12.52
No fertilizer				568.12	568.12	—	—	—	—
600	300	100	8-4-4	1203.37	583.31	620.06	31.00	16.93	14.07
900	450	150	8-4-4	1370.25	598.49	771.76	38.58	25.40	13.18
1200	600	200	8-4-4	1464.37	613.68	850.69	42.53	33.86	8.67
No fertilizer				628.87	628.87	—	—	—	—

The large net profit obtained from the use of complete fertilizer on prairie soils in 1925 led to the placing of two of the more detailed tests in that section this year. The results of these tests are reported in (4) Table 6. The results of the original tests started in 1925 and continued in 1926 on prairie soils of both the red and black types are reported in (5)

TABLE 7—AVERAGE FOUR TESTS, RED PRAIRIE SOIL—1925 AND 1926

Pounds of material applied per acre			Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer			574.85	574.85	—	—	—	—
	300		795.34	565.67	229.68	13.42	8.55	4.87
600	300	75	1048.28	556.48	491.80	28.19	15.84	12.35
No fertilizer			547.29	547.29	—	—	—	—
600	300		1009.14	553.35	455.79	26.37	13.39	12.48
	300	75	837.13	559.42	277.77	16.64	10.50	6.14
No fertilizer			565.48	565.48	—	—	—	—

(4) These tests were conducted in Lowndes and Noxubee Counties in cooperation with Bailey Hardy and Dale Bell.

(5) These tests were conducted in Lowndes County in cooperation with J. H. Hardy and Carey Cocke.

Tables 7 and 8. These results clearly indicate that red soils are more responsive to fertilizers than the black; that where rust is not present very little, if any, returns can be expected from the use of potash on these soils; that both nitrogen and phosphorus are needed and that the use of a proper combination of these two elements is profitable on both the red and the black soils; that the ratio of nitrogen to phosphoric acid should be about the same; and, that when the proper mixture is used profitable returns may be expected from the use of 600 to 100 pounds per acre.

TABLE 8—AVERAGE TWO TESTS, BLACK PRAIRIE SOILS—1925 AND 1926

Pounds of material applied per acre			Pounds of seed cotton per acre			Dollars per acre		
Acid phos.	Nitrate of soda	Sul. of potash	Plot yield	Check yield	Increase	Increase	Cost of fert.	Net gain
No fertilizer			1127.30	1127.30	—	—	—	—
	300		1192.85	1119.05	73.80	4.19	8.55	—4.36
600	300	75	1558.15	1110.80	447.35	27.84	15.84	12.00
No fertilizer			1102.55	1102.55	—	—	—	—
600	300		1390.00	1107.8	282.20	16.58	13.89	2.69
	300	75	1279.70	1113.05	166.65	10.53	10.50	.03
No fertilizer			1118.30	1118.30	—	—	—	—

Tests comparing nitrate of soda, sulphate of ammonia, and calcium cyanamid have been conducted for six years with an average increase in seed cotton from nitrate of soda 174.9 pounds; from sulphate of ammonia 170.0 pounds; from calcium cyanamid 137.0 pounds.

In 1925 other forms of nitrogen added to this test were Leunasaltpeter, calcium nitrate, and Urea. Sufficient data have not been obtained on these to justify conclusions.

Conclusions—The use of fertilizer of the correct analysis will pay well on all worn and unimproved soils tested in east central Mississippi.

Six hundred pounds and more to the acre is an efficient application.

Phosphoric acid and nitrogen are essential elements in fertilizers for these soil types. The ratio of these elements should be equal or nearly equal; that is, eight parts phosphoric acid to eight parts nitrogen, or eight parts phosphoric acid to six parts nitrogen.

Potash is not an essential element in fertilizers for many soils. In the prairie section it has not given profitable returns. In the clay hills and flatwoods section profitable returns have been obtained in many instances. On soils where cotton rusts potash pays. Where large quantities of fertilizer above 600 pounds are used potash should be included.

VARIETIES

The variety tests conducted in 1926 included fifty-two standard and new varieties and new strains of varieties. The sources from which all seed were obtained are listed at the end of this publication.

The low yields reported in these tests were caused by hopper damage and climatic conditions. The cotton flea hopper was present practically all of the growing season and retarded fruiting very materially in the case of the standard variety test and the one for wilt resistance. During August the plants had matured sufficiently to fruit in spite of the hopper

when a period of excessive rainfall began. These rains were so great that very few late bolls were set. The leaf worm was present but was controlled by the use of calcium arsenate. Weevil infestation was spotted. Neither the worm nor the weevil contributed materially to the low yields reported here.

The total per acre money value of each variety is based on $24.00 a ton for cotton seed and average lint prices for middling grade of the indicated length. These average lint prices were obtained by averaging quotations as of November 1 received from the Mississippi Farm Bureau Cotton Marketing Association, Jackson, The Staple Cotton Cooperative Association, Greenwood, Randolph Scott Co., Memphis, and F. P. Phillips, Columbus.

TABLE 9—NINE VARIETIES OF COTTON AT THE CENTRAL STATION

Year	Pounds of lint cotton per acre								
	Half & Half	Cook	Cleve. 54	Cleve. Wan.	Cleve. Pied	Lone Star	Trice	Miller	Delfos
1922	299.1	334.2	315.6	249.8	302.7	308.8	279.0	320.3	262.8
1923	321.3	303.5	344.4	251.6	348.3	299.2	396.5	323.8	368.9
1924	369.9	397.6	397.6	379.5	394.6	352.1	337.6	377.9	306.9
1925	629.5	613.2	615.4	553.3	557.0	492.9	461.3	597.3	460.6
1926	299.1	297.3	262.2	207.0	264.8	266.2	326.2	151.7	329.5
Av. lb.	383.8	389.2	387.0	328.2	373.4	343.8	360.1	354.2	345.7
Av. value	$ 89.89	$94.39	$100.65	$ 81.83	$ 96.73	$ 95.59	$100.48	$ 99.26	$101.23
Av. Length	3-4f	7-8	15-16	13-16f	7-8f	1 1-16f	1 1-16	1 1-16	1 1-8f
Av. per-centage	41.6	38.8	34.9	37.2	34.4	34.0	31.5	34.0	32.2

Choosing a variety well adapted to a given set of conditions is often a difficult task. The table reporting five year average results from nine varieties should be of some value in this connection. The seasonal conditions covered by this table include two very wet seasons (1923 and 1926), two very dry seasons (1924 and 1925), and one nearly normal season (1922). These averages should be dependable so far as yields, lengths, and percentages are concerned.

Readers are sometimes prone to overemphasize certain features of a variety test report. This is often the case when money values are compared and it should be pointed out here that the values used assume that all cotton is to be marketed through an ideal system. That is, it assumes that the grower will be able to obtain whatever premium a given staple may command. While such marketing service may be within the reach of practically all cotton producers, and while many producers are availing themselves of this service by joining cooperative associations or selling through capable and honest factors, the fact remains that the majority of the cotton produced is still sold to agencies which either cannot or will not discriminate between different staple lengths. These things should be borne in mind when money values are studied.

TABLE 10—STANDARD VARIETIES, 1926

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value	Bolls per lb.
	Seed cotton	Lint	Percentage	Length	Cents per lb.			
Trice, Miss. Sta.	1087.4	326.2	30.0	1 f	12.95	51.37	7	76
Trice, Burdette	908.0	287.8	31.7	15-16f	12.37	43.04	12	68
Cleve., Wan.	586.5	207.0	35.3	7-8f	11.67	28.71	20	66
Cleve., Coker	550.6	186.7	33.9	7-8f	11.67	26.16	22	65
Cleve., 54	792.1	262.2	33.1	15-16f	12.37	38.79	16	67
Cleve., Wilson	819.7	261.5	31.9	15-16	12.03	38.16	17	69
Cleve., Pied.	822.5	264.8	32.2	7-8f	11.67	37.59	18	62
Half & Half, Mahon	772.8	299.1	38.7	7-8	11.48	40.02	13	65
Cook 1010	760.4	297.3	39.1	7-8	11.48	39.69	14	74
Willis	968.8	311.0	32.1	15-16	12.03	45.30	10	61
Miller	458.2	151.7	33.1	1 1-16	13.37	23.96	23	59
Acala	517.5	189.1	34.8	1 f	12.95	27.37	21	64
Mex. Pig Boll	411.2	137.8	33.5	1 1-16	13.37	21.70	24	64
D. & P. L. No. 4	654.1	232.2	35.5	1 1-16	13.37	36.11	19	66
D. & P. L. No. 8	674.8	252.4	37.4	1 1-16	13.37	38.82	15	68
Deltatype Webber	873.5	256.8	29.4	1 1-4f	22.37	64.85	2	63
D. & P. L. No. 5	698.3	226.2	32.4	1 3-16f	17.53	45.32	9	65
Delfos 631	917.7	284.5	31.0	1 3-16	16.53	54.63	6	69
Delfos 910	883.0	273.4	31.5	1 3-16f	17.53	55.07	5	64
Delfos 911	1006.0	311.9	31.0	1 1-8f	15.37	56.27	4	73
Delfos 6102	1046.0	329.5	31.5	1 1-8f	15.37	59.24	3	73
D. & P. L. No. 6	1079.9	373.7	34.9	1 3-16	16.53	70.14	1	76
Express, Lightning	815.6	246.3	30.2	1 3-16	16.53	47.54	8	74
Lone Star 65	814.2	266.2	32.7	1 1-16f	13.78	43.26	11	58

TABLE 11—STANDARD AND NEW VARIETIES, 1926

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value	Bolls per lb.
	Seed cotton	Lint	Percentage	Length	Cents per lb.			
Cleve. 54	1135.2	388.6	34.2	1	12.70	58.32	10	64
Cleve., Coker 6A	997.2	362.9	36.7	1 f	12.95	50.00	14	78
Cleve., Coker 6B	897.3	311.4	34.7	1 1-16f	13.78	49.94	15	72
Cleve., Coker Str. 5	947.1	323.0	34.1	1 1-8	14.53	54.42	11	63
Super Seven	1222.9	407.2	33.3	1 1-8	14.53	68.96	4	75
Cleve., Humco 20	769.3	273.9	35.6	7-8f	11.67	37.90	22	66
Addison Prolific	783.5	303.2	38.7	7-8	11.48	40.57	20	67
Lewis Prolific	937.0	340.4	35.2	7-8f	11.67	47.24	16	79
Half & Half, Cleve.	881.6	361.5	41.0	13-16f	11.15	46.55	17	63
Bank Account	735.0	234.7	31.6	7-8f	11.48	36.39	23	80
Kelly Big Boll	796.3	288.3	36.2	1 f	12.95	43.43	19	63
Miller	635.6	215.5	33.9	1 1-16	13.37	33.85	24	58
Haaga 86 1	851.8	323.7	38.0	7-8	11.48	43.50	18	74
Lone Star 65 A 2	895.9	299.2	33.4	1 1-8	14.53	50.63	13	60
Lone Star 168	1015.3	352.3	34.7	1 1-8	14.53	59.15	9	57
Delfos 1341	1100.6	374.2	34.0	1 1-8	14.53	63.09	6	79
Delfos 6102	1157.5	364.6	31.5	1 1-8f	15.37	65.55	5	76
Foster Strain 2	1153.2	373.6	32.4	1 3-16	16.53	71.12	1	72
Carolina Foster	1107.7	342.3	30.9	1 3-16f	17.53	69.19	3	71
Delfos 245	1099.2	350.6	31.9	1 1-8f	15.37	62.87	7	71
Delfos 1374	1013.9	311.3	30.7	1 3-16	16.53	59.89	8	58
Humco Delta 36	1045.2	301.0	28.8	1 1-4	20.37	70.24	2	66
Haaga Long Staple	853.2	247.4	29.0	1 3-16f	17.53	50.64	12	68
Haaga 68	789.2	261.2	33.1	1 f	12.95	40.17	21	62

The picking quality of varieties is another feature which the results of a variety test do not present. The ease with which a variety may be picked is becoming so important that growers are often willing to sacrifice something in yield in order to hasten the harvesting process.

All variety tests reported here were planted between April 20 and 25. All were fertilized uniformly with about 600 pounds of 8-6-4 fertilizer to the acre. Stands were sufficiently uniform to make results comparable.

The test of standard varieties was replicated six times, that of standard and new varieties five times, and the test for wilt resistance four times.

Wilt infection in the test for wilt resistance was greatest with the most susceptible varieties but damage was not as severe as is sometimes the case. This fact was attributed to the liberal use of a complete fertilizer and to the excessive rainfall in August.

The most promising wilt resistant cottons now appear to be lightning Express, Super Seven, Rhyne's Cook, Dixie Triumph, Solomon and Oates Big Boll, and Watson. It will be observed that Trice ranked fifth in money value in the test. It fruits early and rapidly. Late in the season its bolls shriveled until picking was very difficult. This often happens with very early and susceptible varieties.

TABLE 12—TEST FOR WILT RESISTANCE, 1926

Variety	Pounds per acre		Lint data			Total dollars per acre	Rank in value	Bolls per lb.
	Seed cotton	Lint	Percentage	Length	Cents per lb.			
Trice, Miss. Sta.	891	272.6	30.6	1 1-16	13.37	43.87	5	77
Half & Half, Mahon	534	205.6	38.5	7-8	11.48	27.54	19	72
Cook, Rhyne	762	278.1	36.5	15-16	12.03	39.27	9	62
Cook, 307-6	654	228.9	35.0	7-8f	11.67	31.81	16	78
Toole, Mathis	741	263.1	35.5	15-16f	12.37	38.28	11	82
Toole, Perry	753	255.3	33.9	15-16	12.03	36.68	13	70
Cleve., Pied	903	293.5	32.5	15-16f	12.37	43.62	6	61
Cleve., Humco 20	657	231.9	35.3	15-16	12.03	33.00	15	64
Cleve., 54	828	278.2	33.6	1	12.70	41.93	7	66
Super Seven	888	291.3	32.8	1 1-8	14.53	49.49	2	74
Dixie Triumph	888	293.9	33.1	1	12.70	44.46	4	66
Kelly Big Boll	660	236.3	35.8	1 f	12.95	35.68	14	61
Sol. & Oates Big Boll	531	188.0	35.4	1 1-16f	13.78	30.03	17	56
Miller	528	178.5	33.8	1 1-16	13.37	28.06	18	60
D. & P. L. No. 4	669	244.9	36.6	1 1-16	13.37	37.83	12	69
D. & P. L. No. 5	600	192.0	32.0	1 3-16f	17.53	38.56	10	67
Watson	822	259.8	31.6	1 3-16	16.53	49.69	1	66
Lightning Express	846	256.3	30.3	1 3-16	16.53	49.45	3	74
Delfos 6102	771	241.3	31.3	1 1-8	14.53	41.42	8	80

SEED SOURCES, 1926

Acala—L. E. Gleeck, Box 334, Memphis, Tenn.
Addison's Pro.—W. P. Addison, Blackwells, Ga.
Bank Account—H. G. Hastings Co., Atlanta, Ga.
Carolina Foster—Humphrey-Coker Seed Co., Hartsville, S. C.
Cleveland, Coker—Coker Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Coker Strain 5—Coker Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Coker 6A—Coker Pedigreed Seed Co., Hartsville, S. C.

Cleveland, Coker 6B—Coker Pedigreed Seed Co., Hartsville, S. C.
Cleveland, Humco 20—Humphrey-Coker Seed Co., Hartsville, S. C.
Cleveland, Pied.—Piedmont Pedigreed Seed Farms, Commerce Ga.
Cleveland, Wan.—Wannamaker Cleveland Seed Farms, St. Matthews, S. C.
Cleveland, Wilson—Lee Wilson & Co., Wilson, Ark.
Cleveland, 54—Miss. Experiment Station, A. & M. College, Miss.
Cook, Rhyne—Rhyne Bros., Benton, Ala.
Cook 307-6—Alabama Experiment Station, Auburn, Ala.
Cook 1010—D. N. Williamson Estate, Cedar Bluff, Ala.
D. & P. L. No. 4—Delta and Pine Land Co.. Scott, Miss.
D. & P. L. No. 5—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 6—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 8—Delta and Pine Land Co., Scott, Miss.
Delfos 245—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 6102—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 631—C. D. Walcott & Son, Greenville, Miss.
Delfos 910—C. D. Walcott & Son, Greenville, Miss.
Delfos 911—E. J. Ganier, Percy, Miss.
Delfos 1341—Delta Branch Exp. Sta., Stoneville, Miss.
Delfos 1374—Delta Branch Exp. Sta., Stoneville, Miss.
Deltatype Webber—Coker Pedigreed Seed Co., Hartsville, S. C.
Dixie Triumph—L. O. Watson, Florence, S. C.
Express, Lightning—Coker Pedigreed Seed Co., Hartsville, S. C.
Foster Str. 2—Humphrey-Coker Seed Co., Hartsville, S. C.
Haaga 68—Oscar J. Haaga, Memphis, Tenn.
Haaga 86-1—Oscar J. Haaga, Memphis, Tenn.
Haaga Long Staple—Oscar J. Haaga, Memphis, Tenn.
Half & Half, Mahon—H. K. Mahon, Holly Springs, Miss.
Half & Half, Clev.—N. E. Cleveland, Stratton, Miss.
Humco Delta 36—Humphrey-Coker Seed Co., Hartsville, S. C.
Kelly Big Boll—S. O. Kelly, Headland, Ala.
Lewis Prize—W. B. F. Lewis, Liberty, Miss.
Lone Star 65-A2—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Lone Star 65—Miss. Experiment Station, A. & M. College, Miss.
Lone Star 168—Miss. Experiment Station, A. & M. College, Miss.
Mex. Big Boll—Edgecombe Seed Breeders Association, Tarboro, N. C.
Miller—Miss. Experiment Station, A. & M. College, Miss.
Sol. & Oates B. B.—Solomon and Oates, Headland, Ala.
Super Seven—Coker Pedigreed Seed Co., Hartsville, S. C.
Toole, Mathis—W. J. Mathis, Dawson, Ga.
Toole, Perry—J. P. Perry, Dawson, Ga.
Trice, Burdette—Burdette Plantation, Burdette, Ark.
Trice, Miss. Sta.—Miss. Exp. Sta., A. & M. College, Miss.
Watson—L. O. Watson, Florence, S. C.
Willis—Mrs. Stark Willis, Graysport, Miss.

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Steer Feeding Experiments and Actuary

Section I—Molasses Fed with Cottonseed Meal, Silage, and Johnson Grass Hay in Rations for Finishing Steers for Market

Section II—Selling Price of Steers per Hundred-Weight on Farm Necessary to Pay for Cattle and Feed

Geo. S. Templeton and C. J. Goodell

Mississippi Agricultural Experiment Station
A. A. McCall, Director
State College, Mississippi

SUMMARY—SECTION 1

The steers which were fed blackstrap molasses in addition to cottonseed meal, silage, and hay made somewhat larger gains, showed a little more finish, and sold slightly higher per hundred-weight than those receiving cottonseed meal as the sole concentrate. While the molasses increased the cost of the gains, the higher selling price secured for the molasses fed cattle, when compared with those not receiving it, resulted for Lot 2 in an increased return per steer of sixty-seven cents above the initial valuation and feed cost.

The differences in rate of gain, finish, and selling price of Lot 2, receiving a small amount of molasses, and Lot 3, receiving a medium amount of molasses, appear to be insignificant, while the economy of gain and financial showing clearly favor the lighter molasses ration.

Study of these data indicates that while about three pounds of molasses may be added profitably to a steer ration of cottonseed meal, silage, and hay, the use of double this amount is likely to be unprofitable.

Section I--Molasses Fed With Cottonseed Meal, Silage, and Johnson Grass Hay In Rations For Finishing Steers For Market

Geo. S. Templeton and C. J. Goodell

INTRODUCTION

Blackstrap or low grade cane molasses is the uncrystalizable sirupy residue obtained in the manufacture or refinement of cane sugar. For many years, this by-product of the sugar industry was not considered of any special value and it was discarded by the planters as a waste material. More recently, however, its value for feeding purposes has come to be generally recognized.

Blackstrap was first used in stock feeding as a condiment or conditioner. It is relished by all classes of farm animals and it increases the palatability and consumption of the rations with which it is fed.

Blackstrap was first used to a considerable extent for general feeding by the sugar planters who found it valuable in their mule rations, as well as in the feeding of other stock on their plantations. As a result of these practical demonstrations and of trials at various experiment stations, its nutritive value has become widely recognized, large amounts being utilized, especially in the preparation of commercial mixed feeds.

Most of the blackstrap used in this country is produced in Louisiana or is imported from Cuba, Porto Rico, and Hawaii. During 1925, Louisiana produced approximately 22,981,000 gallons. Importations into the United States this same year amounted to 1,305,573 cargo tons, or 256,929,000 gallons. Expressed in percentage, this was an increase of more than 600 per cent over 1913. A little over 60 per cent of these importations was received through the ports of the Gulf Coastal district.

Previous Work

While most of the blackstrap produced or imported in this country is used in the manufacture of industrial alcohol, the increasing availability of this very palatable and highly nutritious concentrate has brought to this and other stations numerous inquiries as to its value in the fattening of cattle. Because of the high sugar content of molasses

it seemed that this feed should be especially suited to balancing rations in which cottonseed meal was the major concentrate.

In 1920, one lot of steers was fed by the Mississippi Experiment Station on an average of 4.8 pounds of cottonseed meal, 6.6 pounds of molasses, and 41.5 pounds of corn silage. This ration was fed in comparison with rations where the concentrates consisted of cottonseed meal alone or cottonseed meal and varying proportions of corn and cottonseed meal. The results indicated a considerable cheapening of the ration at prevailing feed prices and a significant reduction in the feed consumed per hundred-weight of gain, owing to the molasses. In this trial, 100 pounds of molasses apparently saved 48 pounds of cottonseed meal and 402 pounds of silage.

These amounts were identical with the amounts of these feeds saved per hundred pounds of corn fed at the average rate of 4.1 pounds per head daily. The results of this work indicated that molasses had a feeding value about equal, pound for pound, to that of corn when compared with a ration of 4.7 pounds of cottonseed meal, 4.1 pounds of corn, and 40 pounds of corn silage.

As molasses is frequently cheaper per pound than corn, this trial indicated that molasses might be incorporated economically in our standard steer rations for this section.

Plan of Experiment

The Mississippi Experiment Station, therefore, in the fall of 1922 planned an experiment to determine the economy of varying quantities of molasses when fed with cottonseed meal, silage, and hay. Arrangements were made for the feeding of three lots of steers on like amounts of cottonseed meal with silage ad libitum and a small amount of Johnson grass hay. The latter was used in similar amounts in each lot, averaging 2.7 pounds per head daily. In addition to these feeds, blackstrap molasses was included, but in different amounts, in the rations of two of the three lots. The rations by lots were as follows:

Lot 1—Cottonseed meal, 5 to 7 pounds per 1,000 pounds live weight
Silage ad libitum
Johnson grass hay
Salt.

Lot 2—Cottonseed meal, 5 to 7 pounds per 1,000 pounds live weight
Blackstrap molassses, 2½ to 3 pounds.
Silage ad libitum
Johnson grass hay
Salt.

Lot 3—Cottonseed meal, 5 to 7 pounds per 1,000 pounds live weight
Blackstrap molasses, 5 to 6 pounds
Silage ad libitum
Johnson grass hay
Salt.

Cattle Used

The cattle used in this work were mostly yearlings or two year old grade beef steers produced on the Experiment Station farm or purchased locally. A few purebreds from the Station herds were included each year. The steers produced on the Station farm showed more quality than those purchased. The cattle used throughout the trial, while lacking a little in uniformity, would have graded as good to choice feeders.

Preliminary Treatment

For several weeks prior to the beginning of the feeding work each year the cattle were run together on pasture and in the stalk fields, receiving as nearly the same treatment as it was possible for them to be given under farm conditions. A week or ten days before the commencement of the trial, they were brought up to the barns and put on a ration of silage, hay, and two pounds of cottonseed meal. For the purpose of indentification, each steer was given an individual numerical brand at this time.

Weighings

At the beginning of each trial, the steers were weighed individually three days in succession, the average of these three weighings being used as the initial weights. After two of these weighings, the steers were divided into three lots of ten each. In this division, these lots were made as nearly alike as possible in breeding, quality, and condition. On the afternoon following the weighing, the cattle were started on the experimental rations. During the first trial, all of the steers were weighed individually at the end of each twenty-eight days. In the three succeeding trials, they were weighed individually at the end of each fourteen days. At the conclusion of each trial, the steers were weighed three days in succession, the average of these weights being used as the final weights.

Appraisal

At the beginning of each trial, the cattle were appraised by a committee consisting of local stockmen and the head of the Animal Husbandry Department of the Mississippi A. and M. College.

Management

Similar quarters were occupied by all lots, the steers having shelter fourteen feet deep and about thirty-two feet long, opening to the south into lots approximating 7,000 square feet each. Some bedding was used and the sheds were in fairly good condition throughout the experiment. Water was supplied from deep wells and was accessible in the lots at all times. The concentrate portion of the ration was divided into two equal feeds, the steers being fed about 7:30 a. m. and 5:30 p. m., each day. The silage was placed in the troughs first and the meal scattered over and mixed with it. The molasses was diluted with an equal amount of water and then poured over the meal and

silage and all were thoroughly mixed. The feeding and weighing of feeds were done by student feeders under the direction of the animal husbandman in charge of the project. Salt was kept before the cattle. As a considerably greater amount was consumed by the steers in Lot 1 than by those in the other lots, accurate records were kept of the salt consumption the last two years. This is given in the following tabulation:

Salt Consumed by Lots, 1924-25 and 1925-26

	Lot 1 Cottonseed meal as sole concentrate	Lot 2 Cottonseed meal and small amount of molasses	Lot 3 Cottonseed meal and medium amount of molasses
1924-25	30 pounds	9 pounds	15 pounds
1925-26	34 "	8.5 "	11 "

Bringing Cattle on to Feed

Care was necessarily taken in all trials in placing cattle on full feeds, especially the concentrates. A satisfactory rule in the starting of the steers of the weights used on cottonseed meal is to begin with two pounds per head each day, increasing one pound every fourth day until they are receiving five pounds per head daily. Raises may be farther apart after this, in order to utilize roughages to a greater extent in the production of gains during the early part of the feeding period. Throughout the experiment, approximate compliance with this rule avoided any trouble from steers scouring or going off feed during the early part of the feeding periods. Silage was fed at all times in accordance with the appetites of the cattle, or what they would clean up within two hours after feeding. The steers were started on three to five pounds of hay, and as feeding progressed the amounts were adjusted to the appetites of the steers. As the amounts of concentrates were increased, the consumption of hay decreased. After the steers were on full feed, they consumed an average of less than three pounds of hay per head daily.

Feeds

The cottonseed meal used was purchased locally and was of choice grade.* The blackstrap molasses was bought in barrels and shipped from New Orleans. ** Corn and sorghum silages were used, the kind of silage at any one time, however, being the same for all lots. The Johnson grass hay used was grown on the Station farm and, because of the

*For the last three trials, the average analyses of samples of cottonseed meal used showed 43.7 per cent crude protein. Analyses were made by the Chemistry Department of the Mississippi Experiment Station.

**The average analyses of samples of molasses used each of the last three years showed 76 per cent total solids and 6.9 per cent ash.

coarseness of texture, would probably have graded number two.

Cottonseed meal was charged against the cattle each year at the local price at the beginning of the trial. Molasses was charged against the cattle at cost, which included local freight and cooperage. Corn silage was charged at the farm value of the corn contained plus the difference between the cost of ensiling and the cost of cribbing an equal amount of corn. Sorghum silage was charged against the cattle at the estimated value of the corn which would have been produced on the land used in its production, plus the difference between the cost of ensiling and the cost of cribbing that much corn.

Marketing

The cattle each year were shipped to St. Louis, where they were sold by lots and selling and slaughter data were secured. The afternoon following the final weighing, the cattle were turned together and driven to the local loading pens where they were allowed free access to hay and water, other feed being with-held. They were loaded out about 6:30 the next morning, arriving at St. Louis the following day at about 10:30 a. m. Here they were re-divided into lots and sold without either the commission man or buyer knowing the method of feeding which had been employed in either case. The opinions of other bidders were checked against that of the salesman and buyer and in all instances there seemed to be a unanimity of opinion as to relative values.

Summaries by Years

The following tables give the essential data for each year's work. They have been prepared with the view to presenting the results by years in as clear and concise a manner as possible without a surplus of explanations. The photographs accompanying the last three years work will assist in giving an idea of the quality and breeding of the cattle and of differences in finish at the conclusion of the feeding period.

Table 1—Blackstrap Molasses Fed With Cottonseed Meal, Silage and Johnson Grass Hay for Finishing Steers

Date of trial ..... November 29, 1922-March 30, 1923
Length of trial ..... 121 days
Breeding of steers ....Angus, Hereford, and Shorthorn grades and a few purebreds

Age of steers—Yearlings Quality—Good to Choice Initial valuation per cwt.—$5.50 Number of steers per lot—10	Lot No 1 Cottonseed Meal, Silage, Hay	Lot No. 2 Cottonseed Meal, Small amt. of molasses, Silage, Hay	Lot No. 3 Cottonseed Meal, Med. amt. of molasses, Silage, Hay
Average initial weight (lbs.)	690.	694.	697.
Average final weight (lbs.)	965.	982.	1000.
Average gain per steer (lbs.)	275.	288.	303.
Average daily gain per steer (lbs.)	2.3	2.4	2.5
Average weight at market (lbs.)	905.	923.	939.
Average shrink per steer (lbs.)	60.	59.	61.
Per cent of shrink	6.2	6.0	6.1
Dressing per cent, based on market weight	55.9	56.9	57.1
Dressing per cent, based on home weight	52.4	53.5	53.6
Feed consumed per steer			
Cottonseed meal (lbs.)	663.5	663.5	663.5
Molasses (lbs.)	———	313.5	630.5
Silage (lbs.)	5179.	4982.	4902.
Johnson grass hay (lbs.)	470.	473.	457.
Average daily ration			
Cottonseed meal (lbs.)	5.5	5.5	5.5
Molasses (lbs.)	———	2.6	5.2
Silage (lbs.)	42.8	41.2	40.5
Johnson grass hay (lbs.)	3.8	3.9	3.8
Feed consumed per cwt. of gain			
Cottonseed meal (lbs.)	241.	230.	219.
Molasses (lbs.)	———	109.	208.
Silage (lbs.)	1881.	1729.	1616.
Johnson grass hay (lbs.)	171.	164.	151.
Cost of 100 pounds of gain	$ 9.26	$ 9.74	$ 10.17
Cost of steers per cwt. in lots ready to market	$ 6.65	$ 6.82	$ 6.99
Cost of steers per cwt., St. Louis	$ 7.59	$ 7.75	$ 7.94
Necessary margin	$ 2.09	$ 2.25	$ 2.44
Selling price per cwt., St. Louis	$ 8.00	$ 8.25	$ 8.35
Shipping and selling expense per steer	$ 4.52	$ 4.57	$ 4.63
Net receipts per steer	$ 67.88	$ 71.58	$ 73.78
Price received for steers per cwt. on farm	$ 7.03	$ 7.29	$ 7.38
Initial valuation and feed cost per steer	$ 64.13	$ 66.96	$ 69.91
Returns per steer above initial valuation & feed cost	$ 3.75	$ 4.62	$ 3.87

Lot 1 received cottonseed meal, silage, and hay

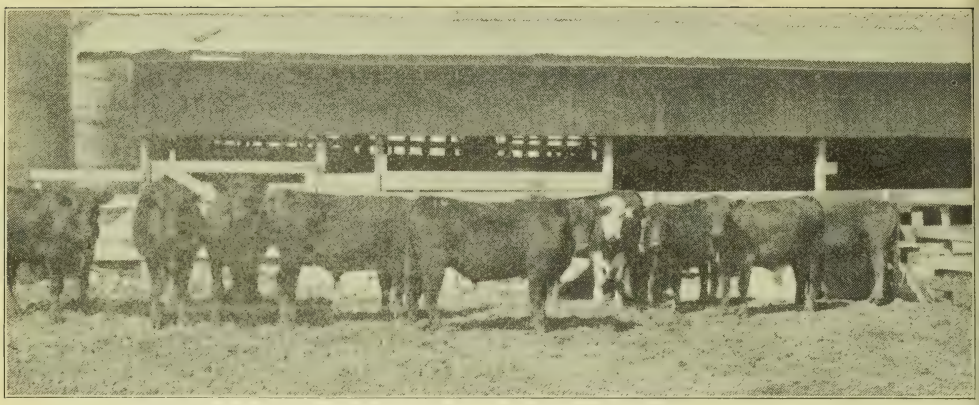
Lot 2 received cottonseed meal, a small amount of molasses, silage, and hay

Lot 3 received cottonseed meal, a medium amount of molasses, silage, and hay

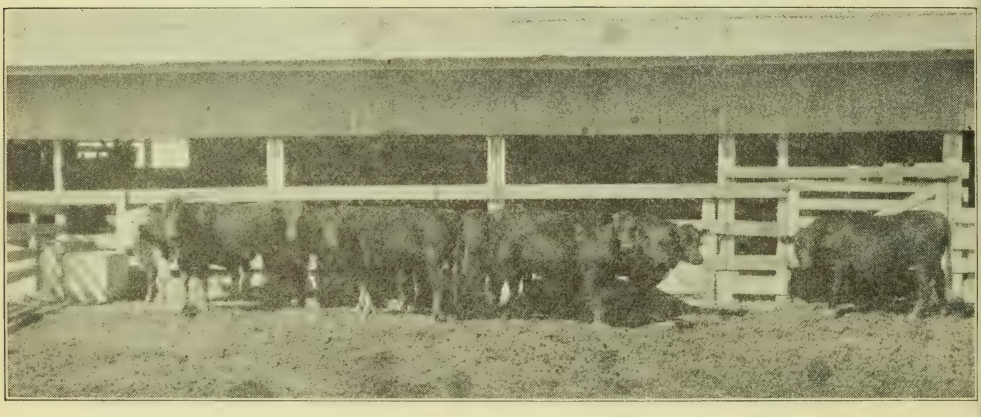
Table 2—Blackstrap Molasses Fed With Cottonseed Meal, Silage and Johnson Grass Hay for Finishing Steers

Date of trial ..... December 5, 1923-March 28, 1924
Length of trial ..... 114 days
Breeding of steers ..... Angus, Hereford, and Shorthorn Grades and a Few Purebreds

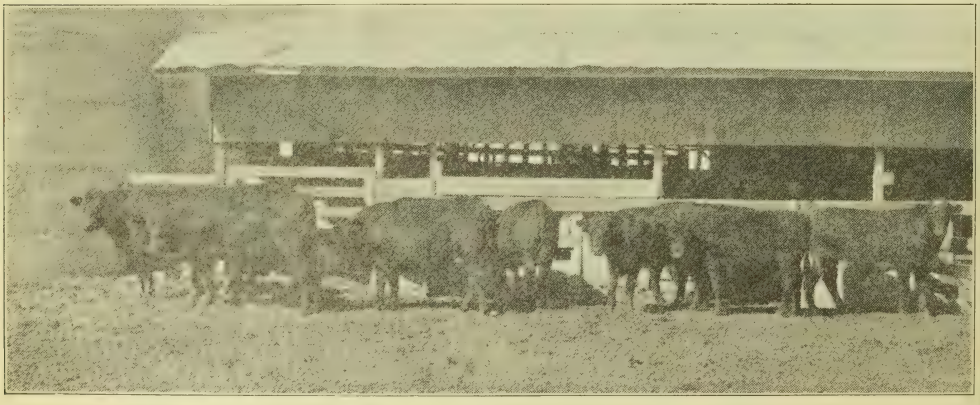
Age of steers—Yearlings Quality—Good to choice Initial valuation per cwt.—$5.50 Number of steers per lot—10	Lot No. 1 Cottonseed Meal, Silage, Hay	Lot No. 2 Cottonseed Meal. Small amt. of molasses, Silage, Hay	Lot No. 3 Cottonseed Meal, Med. amt. of molasses, Silage, Hay
Average initial weight (lbs.)	759.	761.	761.
Average final weight (lbs.)	1010.	1045.	1016.
Average gain per steer (lbs.)	251.	284.	255.
Average daily gain per steer (lbs.)	2.2	2.5	2.2
Average weight at market (lbs)	922.	958.	937.
Average shrink per steer (lbs.)	89.	88.	80.
Per cent of shrink	8.8	8.4	7.8
Dressing per cent, based on market weight	57.9	58.2	59.3
Dressing per cent, based on home weight	52.8	53.3	54.6
Feed consumed per steer			
Cottonseed meal (lbs.)	552.	552.	552.
Molasses (lbs.)	———	291.	582.
Silage (lbs.)	5369.	5027.	4656.
Johnson grass hay (lbs.)	185.	172.	184.
Average daily ration			
Cottonseed meal (lbs.)	4.8	4.8	4.8
Molasses (lbs.)	———	2.55	5.1
Silage (lbs.)	47.	44.	41.
Johnson grass hay (lbs.)	1.6	1.5	1.6
Feed consumed per cwt. of gain			
Cottonseed meal (lbs.)	219.	194.	216.
Molasses (lbs.)	———	102.	228.
Silage (lbs.)	2134.	1767.	1823.
Johnson grass hay (lbs.)	74.	60.	72.
Cost of 100 pounds of gain	$12.09	$11.63	$14.08
Cost of steers per cwt. in lots ready to market	$ 7.15	$ 7.18	$ 7.63
Cost of steers per cwt., St. Louis	$ 8.40	$ 8.40	$ 8.88
Necessary margin	$ 2.90	$ 2.90	$ 3.38
Selling price per cwt., St. Louis	$ 9.50	$10.00	$ 9.75
Shipping and selling expense per steer	$ 5.28	$ 5.44	$ 5.35
Net receipts per steer	$82.31	$90.36	$86.01
Price received per steer per cwt. on farm	$ 8.15	$ 8.65	$ 8.47
Initial valuation and feed cost per steer	$72.17	$75.04	$77.82
Returns per steer above initial valuation & feed cost	$10.14	$15.32	$ 8.19



Lot 1 received cottonseed meal, silage, and hay



Lot 2 received cottonseed meal, a small amount of molasses, silage, and hay



Lot 3 received cottonseed meal, a medium amount of molasses, silage, and hay

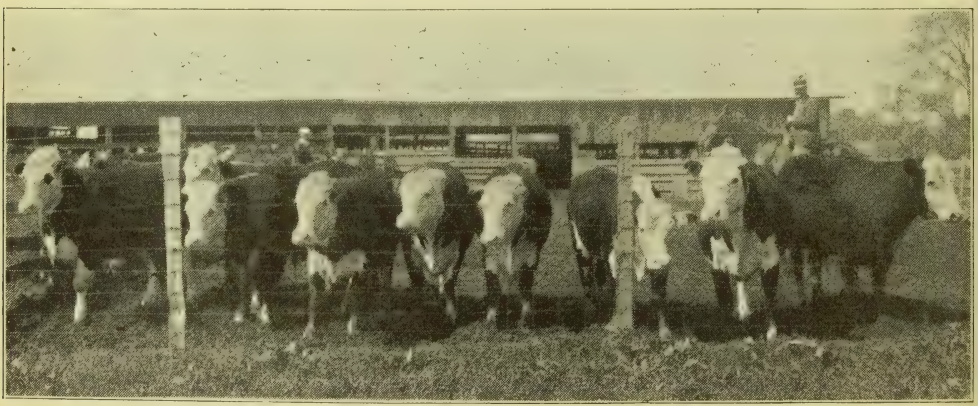
Table 3—Blackstrap Molasses Fed With Cottonseed Meal, Silage and Johnson Grass Hay for Finishing Steers

Date of trial ..... December 16, 1924-March 20, 1925
Length of trial ..... 94 days
Breeding of steers ..... Angus, Hereford, and Shorthorn grades and a few Purebreds

Age of steers—Yearlings and two year olds Quality—Good to choice Initial valuation per cwt.—$5.50 Number of steers per lot—10	Lot No. 1 Cottonseed Meal, Silage, Hay	Lot No. 2 Cottonseed Meal, Small amt. of molasses, Silage, Hay	Lot No. 3 Cottonseed Meal, Med. amt. of molasses, Silage, Hay
Average initial weight (lbs.)	850.	848.	854.
Average final weight (lbs.)	1079	1076.	1102.
Average gain per steer (lbs.)	229.	228.	248.
Average daily gain per steer (lbs.)	2.4	2.4	2.6
Average weight at market (lbs.)	1005.	991.	1014.
Average shrink per steer (lbs.)	74.	85.	88.
Per cent of shrink	6.8	7.9	8.0
Dressing per cent, based on market weight	56.2	58.1	56.5
Dressing per cent, based on home weight	52.3	53.5	51.9
Feed consumed per steer			
Cottonseed meal (lbs.)	488.	488.	488.
Molasses (lbs.)	———	236.	472.
Silage (lbs.)	5021.	4749.	4743.
Johnson grass hay (lbs.)	226.	217.	218.
Average daily ration			
Cottonseed meal (lbs.)	5.2	5.2	5.2
Molasses (lbs.)	———	2.5	5.0
Silage (lbs.)	53.	50.	50.
Johnson grass hay (lbs.)	2.4	2.3	2.3
Feed consumed per cwt. of gain			
Cottonseed meal (lbs.)	212.	213.	195.
Molasses (lbs.)	———	103.	190.
Silage (lbs.)	2187.	2073.	1904.
Johnson grass hay (lbs.)	98.	95.	88.
Cost of 100 pounds of gain	$11.64	$12.71	$12.97
Cost of steers per cwt. in lots ready to market	$ 6.81	$ 7.04	$ 7.20
Cost of steers per cwt., St. Louis	$ 7.92	$ 8.25	$ 8.43
Necessary margin	$ 2.42	$ 2.75	$ 2.93
Selling price per cwt., St. Louis	$ 9.25	$ 9.25	$ 9.25
Shipping and selling expense per steer	$ 6.12	$ 6.03	$ 6.17
Net receipts per steer	$86.84	$85.64	$87.62
Price received per cwt. on farm	$ 8.05	$ 7.96	$ 7.95
Initial valuation and feed cost per steer	$73.51	$75.75	$79.29
Returns per steer above initial valuation & feed cost	$13.33	$ 9.89	$ 8.33

Lot 1 received cottonseed meal, silage and hay

Lot 2 received cottonseed meal, a small amount of molasses, silage, and hay



Lot 3 received cottonseed meal, a medium amount of molasses, silage, and hay

Table 4—Blackstrap Molasses Fed With Cottonseed Meal, Silage and Johnson Grass Hay for Finishing Steers

Date of trial ---------- December 9, 1925, April 16, 1926
Length of trial ---------- 128 days
Breeding of Steers ---------- Grade Herefords

Age of steers—Yearlings and a few two year olds Quality—Good to choice Initial valuation per cwt.—$6.50 Number of steers per lot—10	Lot No. 1 Cottonseed Meal, Silage, Hay	Lot No. 2 Cottonseed Meal, Small amt. of molasses, Silage, Hay	Lot No. 3 Cottonseed Meal, Med. amt. of molasses, Silage, Hay
Average initial weight (lbs.)	682.	673.	674.
Average final weight (lbs.)	966.	983.	1004.
Average gain per steer (lbs.)	284.	309.	329.
Average daily gain per steer (lbs.)	**2.2**	**2.4**	**2.6**
Average weight at market (lbs.)	904.	898.	937.
Average shrink per steer (lbs.)	62.	85.	67.
Per cent of shrink	6.4	8.7	6.7
Dressing per cent, based on market weight	56.5	58.9	57.8
Dressing per cent, based on home weight	52.8	58.8	53.9
Feed consumed per steer			
Cottonseed meal (lbs.)	683.	683.	683.
Molasses (lbs.)	———	332.	665.
Silage (lbs.)	5656.	5535.	5476.
Johnson grass hay (lbs.)	384.	384.	384.
Average daily ration			
Cottonseed meal (lbs.)	5.3	5.3	5.3
Molasses (lbs.)	———	2.6	5.2
Silage (lbs.)	44.	43.	43.
Johnson grass hay (lbs.)	3.	3.	3.
Feed consumed per cwt. of gain			
Cottonseed meal (lbs.)	**240.**	**221.**	**207.**
Molasses (lbs.)	———	**107.**	**201.**
Silage (lbs.)	**1991.**	**1791.**	**1660.**
Johnson grass hay (lbs.)	**135.**	**124.**	**116.**
Cost of 100 pounds of gain	$ 9.02	$ 9.69	$10.42
Cost of steers per cwt. in lots ready to market	$ 7.24	$ 7.50	$ 7.79
Cost of steers per cwt., St. Louis	$ 8.35	$ 8.82	$ 8.96
Necessary margin	$ 1.85	$ 2.32	$ 2.46
Selling price per cwt., St. Louis	$ 8.40	$ 8.95	$ 8.90
Shipping and selling expense per steer	$ 5.51	$ 5.48	$ 5.72
Net receipts per steer	$70.43	$74.89	$77.67
Price received per steer per cwt. on farm	$ 7.29	$ 7.62	$ 7.74
Initial valuation and feed cost per steer	$69.98	$73.73	$78.24
Returns per steer above initial valuation and feed cost	$ .45	$ 1.16	−$ .57

General Summary

Treating Lots 1, 2, and 3 throughout the experiment as single lots, the following tabulation summarizes the results of the four years work.*

A study of individual gains indicates a significant difference between the rate of gain in Lot 1, receiving cottonseed meal as the sole concentrate, and Lots 2 and 3 where molasses was fed in addition to the meal. The difference in the rate of gain between Lot 2, receiving a small amount of molasses, and Lot 3, receiving a medium amount of molasses, does not seem to be significant and could have been due to inherent differences in the cattle.

Except in 1923-24, the dry matter consumed per hundred-weight of gain increased as molasses was added or increased in the ration. The salt consumption was less in the lots receiving molasses than where no molasses was fed.

The cost of the steers per hundred-weight ready to market increased with the use of molasses, as did the necessary margin. The selling price per hundred-weight in the case of Lot 2, receiving the smaller amount of molasses, was enough greater than in Lot 1 to offset the higher cost of gains and allow a slightly greater profit per steer. This was not true in Lot 3 where the higher cost of gains resulted in a return per steer above initial valuation and feed cost of $4.83, as compared with $7.07 in Lot 1 and $7.74 in Lot 2. The shrink enroute to market was fairly uniform from year to year and between lots. There seems to have been a pretty close correlation between the purchase price, and the dressing per cent and finish of the cattle.

*Weighted averages have been used in this tabulation.

Table 5—Blackstrap Molasses fed With Cottonseed Meal, Silage and Johnson Grass Hay for Finishing Steers

Summary of Four Years Work, 1922-26

Average length of feeding periods _____ 114 days

Breeding of steers _____Angus, Hereford, and Shorthorn Grades, and a Few Purebreds

Age of steers—Yearlings and a few two year olds Quality—Good to choice Average initial valuation per cwt.—$5.73 Number of steers per lot (during 4 trials)—40	Lot No. 1 Cottonseed Meal, Silage, Hay	Lot No. 2 Cottonseed Meal, Small amt. of molasses, Silage, Hay	Lot No. 3 Cottonseed Meal, Med. amt. of molasses, Silage, Hay
Average initial weight (lbs.)	745.	744.	746.
Average final weight (lbs.)	1005.	1021.	1030.
Average gain per steer (lbs.)	260.	277.	284.
Average daily gain per steer (lbs.)	**2.28**	**2.43**	**2.49**
Average weight at market (lbs.)	934.	942.5	957.
Average shrink per steer (lbs.)	71.	78.5	73.
Per cent of shrink	7.1	7.7	7.1
Dressing per cent, based on market weight	56.6	58.	57.7
Dressing per cent, based on home weight	52.6	53.5	53.5
Feed consumed per steer			
Cottonseed meal (lbs.)	597.	597.	597.
Molasses (lbs.)	———	293.	587.
Silage (lbs.)	5306.	5073.	4944.
Johnson grass hay (lbs.)	316.	312.	311.
Average daily ration			
Cottonseed meal (lbs.)	5.24	5.24	5.24
Molasses (lbs.)	———	2.57	5.15
Silage (lbs.)	46.5	44.5	43.4
Johnson grass hay (lbs.)	2.8	2.7	2.7
Feed consumed per cwt. of gain			
Cottonseed meal (lbs.)	**230.**	**216.**	**210.**
Molasses (lbs.)	———	**106.**	**207.**
Silage (lbs.)	**2041.**	**1832.**	**1741.**
Johnson grass hay (lbs.)	**122.**	**113.**	**110.**
Cost of 100 pounds of gain	$10.43	$10.94	$11.87
Cost of steers per cwt. in lots ready to market	$ 6.94	$ 7.14	$ 7.42
Cost of steers per cwt., St. Louis	$ 8.05	$ 8.30	$ 8.56
Necessary margin	$ 2.32	$ 2.57	$ 2.83
Selling price per cwt., St. Louis	$ 8.80	$ 9.12	$ 9.06
Shipping and selling expense per steer	$ 5.36	$ 5.38	$ 5.47
Net receipt per steer	$76.86	$80.62	$81.27
Price received per steer per cwt. on farm	$ 7.65	$ 7.90	$ 7.89
Initial valuation and feed cost per steer	$69.79	$72.88	$76.44
Return per steer above initial valuation & feed cost	$ 7.07	$ 7.74	$ 4.83

Section II--Selling Price of Steers Per Hundred Weight on Farm Necessary to Pay for Cattle and Feed

The tables in this section are estimates of the selling price of steers on the farm necessary in order that stockmen and farmers may break even on their feeding operations. These are for different methods of feeding practiced in this section and the estimates are shown for varying feed and feeder costs. They are based on results with sufficient numbers to be reasonably accurate for the class and weight of cattle described and are certainly the most reliable guides available to our cattle feeders at this time.

With the exception of Tables 15 and 16, computations in this section are based entirely on results of feeding operations at this Station. Tables 15 and 16 are based on a compilation by Henry and Morrison of the results of work done by the Mississippi, North Carolina, South Carolina, Alabama, and Tennessee Experiment Stations, and by the United States Department of Agriculture.*

Using Tables

EXAMPLE

I have, or can buy, some 800 pound two to three year old steers at a cost of $5.50 per hundred-weight on the farm. Feed values are as follows:

Cottonseed meal	$35.00 per ton
Corn	.80 per bushel
Molasses	.12 per gallon
Silage	4.00 per ton
Cottonseed hulls	6.00 per ton

What will I have to get per hundred-weight for these steers on the farm, after finishing them for the market, according to the methods of feeding most generally approved for this section?

Answer By Tables

Using cottonseed meal, Johnson grass hay worth $12.00 per ton, and silage, I would have to get, according to Table 7, $6.63.

Using cottonseed meal, molasses, Johnson grass hay worth $12.00 per ton, and silage, I would have to get, according to Table 7, $6.75.

Using a heavy feed of corn with cottonseed meal and silage, I would have to get, according to Table 9, $7.31

Using meal and hulls, I would have to get, according to Table 16, $6.62.

*Henry and Morrison, eighteenth edition, page 494.

TABLE 6—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—745 pounds

Quality—Good to choice. Average length of feeding period—114 days.

SILAGE—$4.00 PER TON FEEDS USED— { Cottonseed meal, molasses, Silage, hay / Cottonseed meal, silage, hay }

Molasses per. gal. (Cents)	$5.00	$5.50	$6.00	$6.50	$7.00	$7.50	$8.00
			Cost of Feeders cwt.				
			Cottonseed Meal $20.00 per ton				
	5.55	**5.92**	**6.29**	**6.66**	**7.03**	**7.40**	**7.77**
6	5.55	5.92	6.28	6.64	7.01	7.37	7.74
9	5.63	5.99	6.35	6.72	7.08	7.45	7.81
12	5.70	6.06	6.43	6.79	7.16	7.52	7.89
15	5.77	6.14	6.50	6.87	7.23	7.60	7.96
			Cottonseed Meal—$25.00 per ton				
	5.69	**6.06**	**6.43**	**6.81**	**7.18**	**7.55**	**7.92**
6	5.70	6.06	6.43	6.79	7.16	7.52	7.88
9	5.77	6.14	6.50	6.87	7.23	7.59	7.96
12	5.85	6.21	6.57	6.94	7.30	7.67	8.03
15	5.92	6.28	6.65	7.01	7.38	7.74	8.11
			Cottonseed Meal—$30.00 per ton				
	5.84	**6.21**	**6.58**	**6.95**	**7.32**	**7.70**	**8.07**
9	5.92	6.28	6.65	7.01	7.38	7.74	8.11
12	5.99	6.36	6.72	7.09	7.45	7.81	8.18
15	6.07	6.43	6.80	7.16	7.52	7.89	8.25
18	6.14	6.50	6.87	7.23	7.60	7.96	8.33
			Cottonseed Meal—$35.00 per ton				
	5.99	**6.36**	**6.73**	**7.10**	**7.47**	**7.84**	**8.21**
9	6.07	6.43	6.79	7.16	7.52	7.89	8.25
12	6.14	6.50	6.87	7.23	7.60	7.96	8.33
15	6.21	6.58	6.94	7.31	7.67	8.03	8.40
18	6.29	6.65	7.02	7.38	7.74	8.11	8.47
			Cottonseed Meal—$40.00 per ton				
	6.14	**6.51**	**6.88**	**7.25**	**7.62**	**7.99**	**8.36**
9	6.21	6.58	6.94	7.30	7.67	8.03	8.40
12	6.28	6.65	7.01	7.38	7.74	8.11	8.47
15	6.36	6.72	7.09	7.45	7.82	8.18	8.55
18	6.43	6.80	7.16	7.53	7.89	8.25	8.62
			Cottonseed Meal—$45.00 per ton				
	6.29	**6.66**	**7.03**	**7.40**	**7.77**	**8.14**	**8.51**
9	6.36	6.72	7.09	7.45	7.82	8.18	8.54
12	6.43	6.80	7.16	7.52	7.89	8.25	8.62
15	6.51	6.87	7.23	7.60	7.96	8.33	8.69
18	6.58	6.94	7.31	7.67	8.04	8.40	8.76
			Cottonseed Meal—$50.00 per ton				
	6.44	**6.81**	**7.18**	**7.55**	**7.92**	**8.29**	**8.66**
12	6.58	6.94	7.31	7.67	8.04	8.40	8.76
15	6.65	7.02	7.38	7.74	8.11	8.47	8.84
18	6.72	7.09	7.45	7.82	8.18	8.55	8.91
21	6.80	7.16	7.53	7.89	8.26	8.62	8.98
			Cottonseed Meal—$55.00 per ton				
	6.58	**6.96**	**7.33**	**7.70**	**8.07**	**8.44**	**8.81**
12	6.72	7.09	7.45	7.82	8.18	8.54	8.91
15	6.80	7.16	7.53	7.89	8.25	8.62	8.98
18	6.87	7.24	7.60	7.96	8.33	8.69	9.06
21	6.94	7.31	7.67	8.04	8.40	8.77	9.13
			Cottonseed Meal—$60.00 per ton				
	6.73	**7.10**	**7.47**	**7.85**	**8.22**	**8.59**	**8.96**
12	6.87	7.23	7.60	7.96	8.33	8.69	9.06
15	6.94	7.31	7.67	8.04	8.40	8.77	9.13
18	7.02	7.38	7.75	8.11	8.47	8.84	9.20
21	7.09	7.46	7.82	8.18	8.55	8.91	9.28
			Cottonseed Meal—$65.00 per ton				
	6.88	**7.25**	**7.62**	**7.99**	**8.36**	**8.73**	**9.11**
15	7.09	7.45	7.82	8.18	8.55	8.91	9.28
18	**7.16**	**7.53**	**7.89**	**8.26**	**8.62**	**8.99**	**9.35**
21	**7.24**	**7.60**	**7.97**	**8.33**	**8.69**	**9.06**	**9.42**
24	**7.31**	**7.67**	**8.04**	**8.40**	**8.77**	**9.13**	**9.50**

TABLE 7—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds
Quality—Good to choice.
Average initial weight—745 pounds.
Average length of feeding period—114 days.

SILAGE—$5.00 PER TON Feeds Used—{ Cottonseed meal, molasses, silage, hay / Cottonseed meal, silage, hay }

Molasses per gal. (cents)	$5.00	$5.50	$6.00	$6.50	$7.00	$7.50	$8.00
			Cottonseed Meal—$20.00 per ton				
	5.81	**6.18**	**6.55**	**6.92**	**7.29**	**7.66**	**8.03**
6	5.80	6.17	6.53	6.89	7.26	7.62	7.99
9	5.88	6.24	6.60	6.97	7.33	7.70	8.06
12	5.95	6.31	6.68	7.04	7.41	7.77	8.14
15	6.02	6.39	6.75	7.12	7.48	7.84	8.21
			Cottonseed Meal—$25.00 per ton				
	5.96	**6.33**	**6.70**	**7.07**	**7.44**	**7.81**	**8.18**
6	5.95	6.31	6.68	7.04	7.41	7.77	8.13
9	6.02	6.39	6.75	7.11	7.48	7.84	8.21
12	6.10	6.46	6.82	7.19	7.55	7.92	8.28
15	6.17	6.53	6.90	7.26	7.63	7.99	8.35
			Cottonseed Meal—$30.00 per ton				
	6.11	**6.48**	**6.85**	**7.22**	**7.59**	**7.96**	**8.33**
9	6.17	6.53	6.90	7.26	7.63	7.99	8.35
12	6.24	6.61	6.97	7.33	7.70	8.06	8.43
15	6.31	6.68	7.04	7.41	7.77	8.14	8.50
18	6.39	6.75	7.12	7.48	7.85	8.21	8.57
			Cottonseed Meal—$35.00 per ton				
	6.25	**6.63**	**7.00**	**7.37**	**7.74**	**8.11**	**8.48**
9	6.31	6.68	7.04	7.41	7.77	8.14	8.50
12	6.39	6.75	7.12	7.48	7.84	8.21	8.57
15	6.46	6.83	7.19	7.55	7.92	8.28	8.65
18	6.53	6.90	7.26	7.63	7.99	8.36	8.72
			Cottonseed Meal—$40.00 per ton				
	6.40	**6.77**	**7.14**	**7.52**	**7.89**	**8.26**	**8.63**
9	6.46	6.82	7.19	7.55	7.92	8.28	8.65
12	6.53	6.90	7.26	7.63	7.99	8.36	8.72
15	6.61	6.97	7.34	7.70	8.06	8.43	8.79
18	6.68	7.05	7.41	7.77	8.14	8.50	8.87
			Cottonseed Meal—$45.00 per ton				
	6.55	**6.92**	**7.29**	**7.66**	**8.03**	**8.40**	**8.78**
9	6.61	6.97	7.34	7.70	8.06	8.43	8.79
12	6.68	7.04	7.41	7.77	8.14	8.50	8.87
15	6.75	7.12	7.48	7.85	8.21	8.58	8.94
18	6.83	7.19	7.56	7.92	8.28	8.65	9.01
			Cottonseed Meal—$50.00 per ton				
	6.70	**7.07**	**7.44**	**7.81**	**8.18**	**8.55**	**8.92**
12	6.83	7.19	7.55	7.92	8.28	8.65	9.01
15	6.90	7.26	7.63	7.99	8.36	8.72	9.09
18	6.97	7.34	7.70	8.07	8.43	8.80	9.16
21	7.05	7.41	7.78	8.14	8.50	8.87	9.23
			Cottonseed Meal—$55.00 per ton				
	6.85	**7.22**	**7.59**	**7.96**	**8.33**	**8.70**	**9.07**
12	6.97	7.34	7.70	8.07	8.43	8.79	9.16
15	7.05	7.41	7.77	8.14	8.50	8.87	9.23
18	7.12	7.48	7.85	8.21	8.58	8.94	9.31
21	7.19	7.56	7.92	8.29	8.65	9.01	9.38
			Cottonseed Meal—$60.00 per ton				
	7.00	**7.37**	**7.74**	**8.11**	**8.48**	**8.85**	**9.22**
12	7.12	7.48	7.85	8.21	8.58	8.94	9.30
15	7.19	7.56	7.92	8.29	8.65	9.01	9.38
18	7.26	7.63	7.99	8.36	8.72	9.09	9.45
21	7.34	7.70	8.07	8.43	8.80	9.16	9.53
			Cottonseed Meal—$65.00 per ton				
	7.15	**7.52**	**7.89**	**8.26**	**8.63**	**9.00**	**9.37**
15	7.34	7.70	8.07	8.43	8.80	9.16	9.52
18	7.41	7.78	8.14	8.50	8.87	9.23	9.60
21	7.49	7.85	8.21	8.58	8.94	9.31	9.67
24	7.56	7.92	8.29	8.65	9.02	9.38	9.75

TABLE 8—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—745 pounds.
Quality—Good to choice. Average length of feeding period—114 days.

SILAGE—$6.00 PER TON Feeds Used— Cottonseed meal, molasses, silage, hay / Cottonseed meal, silage, hay

Molasses per gal. (cents)	Cost of Feeders per cwt. $5.00	$5.50	$6.00	$6.50	$7.00	$7.50	$8.00
			Cottonseed Meal—$20.00 per ton				
	6.07	**6.44**	**6.81**	**7.18**	**7.56**	**7.93**	**8.30**
6	6.05	6.41	6.78	7.14	7.51	7.87	8.24
9	6.12	6.49	6.85	7.22	7.58	7.95	8.31
12	6.20	6.56	6.93	7.29	7.65	8.02	8.38
15	6.27	6.64	7.00	7.36	7.73	8.09	8.46
			Cottonseed Meal—$25.00 per ton				
	6.22	**6.59**	**6.96**	**7.33**	**7.70**	**8.07**	**8.45**
6	6.20	6.56	6.93	7.29	7.65	8.02	8.38
9	6.27	6.63	7.00	7.36	7.73	8.09	8.46
12	6.34	6.71	7.07	7.44	7.80	8.17	8.53
15	6.42	6.78	7.15	7.51	7.87	8.24	8.60
			Cottonseed Meal—$30.00 per ton				
	6.37	**6.74**	**7.11**	**7.48**	**7.85**	**8.22**	**8.59**
9	6.42	6.78	7.14	7.51	7.87	8.24	8.60
12	6.49	6.85	7.22	7.58	7.95	8.31	8.68
15	6.56	6.93	7.29	7.66	8.02	8.39	8.75
18	6.64	7.00	7.37	7.73	8.09	8.46	8.82
			Cottonseed Meal—$35.00 per ton				
	6.52	**6.89**	**7.26**	**7.63**	**8.00**	**8.37**	**8.74**
9	6.56	6.93	7.29	7.66	8.02	8.38	8.75
12	6.64	7.00	7.36	7.73	8.09	8.46	8.82
15	6.71	7.07	7.44	7.80	8.17	8.53	8.90
18	6.78	7.15	7.51	7.88	8.24	8.60	8.97
			Cottonseed Meal—$40.00 per ton				
	6.67	**7.04**	**7.41**	**7.78**	**8.15**	**8.52**	**8.89**
9	6.71	7.07	7.44	7.80	8.17	8.53	8.89
12	6.78	7.15	7.51	7.88	8.24	8.60	8.97
15	6.86	7.22	7.58	7.95	8.31	8.68	9.04
18	6.93	7.29	7.66	8.02	8.39	8.75	9.12
			Cottonseed Meal—$45.00 per ton				
	6.82	**7.19**	**7.56**	**7.93**	**8.30**	**8.67**	**9.04**
9	6.85	7.22	7.58	7.95	8.31	8.68	9.04
12	6.93	7.29	7.66	8.02	8.39	8.75	9.11
15	7.00	7.37	7.73	8.10	8.46	8.82	9.19
18	7.08	7.44	7.80	8.17	8.53	8.90	9.26
			Cottonseed Meal—$50.00 per ton				
	6.96	**7.33**	**7.71**	**8.08**	**8.45**	**8.82**	**9.19**
12	7.07	7.44	7.80	8.17	8.53	8.90	9.26
15	7.15	7.51	7.88	8.24	8.61	8.97	9.33
18	7.22	7.59	7.95	8.31	8.68	9.04	9.41
21	7.30	7.66	8.02	8.39	8.75	9.12	9.48
			Cottonseed Meal—$55.00 per ton				
	7.11	**7.48**	**7.85**	**8.22**	**8.60**	**8.97**	**9.34**
12	7.22	7.59	7.95	8.31	8.68	9.04	9.41
15	7.29	7.66	8.02	8.39	8.75	9.12	9.48
18	7.37	7.73	8.10	8.46	8.83	9.19	9.55
21	7.44	7.81	8.17	8.53	8.90	9.26	9.63
			Cottonseed Meal—$60.00 per ton				
	7.26	**7.63**	**8.00**	**8.37**	**8.74**	**9.11**	**9.48**
12	7.37	7.73	8.10	8.46	8.82	9.19	9.55
15	7.44	7.80	8.17	8.53	8.90	9.26	9.63
18	7.51	7.88	8.24	8.61	8.97	9.34	9.70
21	7.59	7.95	8.32	8.68	9.05	9.41	9.77
			Cottonseed Meal—$65.00 per ton				
	7.41	**7.78**	**8.15**	**8.52**	**8.89**	**9.26**	**9.63**
15	7.59	7.95	8.32	8.68	9.04	9.41	9.77
18	7.66	8.02	8.39	8.75	9.12	9.48	9.85
21	**7.73**	8.10	8.46	8.83	9.19	**9.56**	9.92
24	**7.81**	**8.17**	**8.54**	**8.90**	**9.26**	**9.63**	**9.99**

TABLE 9—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $4.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds.
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$5.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
				Cottonseed Meal—$20.00 per ton					
	6.01			**6.39**			**6.77**		
.50	6.06	6.19	6.28	6.43	6.55	6.64	6.80	6.92	6.99
.60	6.15	6.37	6.54	6.52	6.73	6.90	6.89	7.10	7.26
.70	6.24	6.55	6.80	6.61	6.91	7.16	6.98	7.28	7.52
.80	6.33	6.73	7.06	6.70	7.09	7.42	7.08	7.46	7.78
				Cottonseed Meal—$25.00 per ton					
	6.17			**6.55**			**6.93**		
.50	6.19	6.30	6.36	6.56	6.66	6.72	6.94	7.03	7.08
.60	6.29	6.48	6.62	6.66	6.84	6.98	7.03	7.21	7.34
.70	6.38	6.66	6.88	6.75	7.02	7.24	7.12	7.39	7.60
.80	6.47	6.84	7.15	6.84	7.20	7.51	7.21	7.57	7.86
				Cottonseed Meal—$30.00 per ton					
	6.33			**6.71**			**7.09**		
.60	6.42	6.59	6.70	6.79	6.95	7.06	7.16	7.32	7.42
.70	6.51	6.77	6.97	6.88	7.13	7.33	7.26	7.50	7.69
.80	6.61	6.95	7.23	6.98	7.31	7.59	7.35	7.68	7.95
.90	6.70	7.13	7.49	7.07	7.49	7.85	7.44	7.86	8.21
				Cottonseed Meal—$35.00 per ton					
	6.50			**6.88**			**7.26**		
.60	6.56	6.70	6.79	6.93	7.06	7.15	7.30	7.42	7.51
.70	6.65	6.88	7.05	7.02	7.24	7.41	7.39	7.60	7.77
.80	6.74	7.06	7.31	7.11	7.42	7.67	7.48	7.78	8.03
.90	6.83	7.24	7.57	7.21	7.60	7.93	7.58	7.97	8.29
				Cottonseed Meal—$40.00 per ton					
	6.66			**7.04**			**7.42**		
.70	6.78	6.98	7.13	7.16	7.35	7.49	7.53	7.71	7.85
.80	6.88	7.16	7.40	7.25	7.53	7.75	7.62	7.89	8.11
.90	6.97	7.35	7.66	7.34	7.71	8.02	7.71	8.07	8.38
1.00	7.06	7.53	7.92	7.43	7.89	8.28	7.80	8.25	8.64
				Cottonseed Meal—$45.00 per ton					
	6.82			**7.20**			**7.58**		
.80	7.01	7.27	7.48	7.38	7.64	7.84	7.76	8.00	8.20
.90	7.11	7.45	7.74	7.48	7.82	8.10	7.85	8.18	8.46
1.00	7.20	7.63	8.00	7.57	8.00	8.36	7.94	8.36	8.72
1.10	7.29	7.81	8.27	7.66	8.18	8.62	8.03	8.54	8.98
				Cottonseed Meal—$50.00 per ton					
	6.98			**7.36**			**7.74**		
.90	7.24	7.56	7.82	7.61	7.93	8.18	7.98	8.29	8.54
1.00	7.33	7.74	8.09	7.70	8.11	8.45	8.08	8.47	8.80
1.10	7.43	7.92	8.35	7.80	8.29	8.71	8.17	8.65	9.07
1.20	7.52	8.10	8.61	7.89	8.47	8.97	8.26	8.83	9.33
				Cottonseed Meal—$55.00 per ton					
	7.15			**7.53**			**7.91**		
1.00	7.47	7.85	8.17	7.84	8.22	8.53	8.21	8.58	8.89
1.10	7.56	8.03	8.43	7.93	8.40	8.79	8.30	8.76	9.15
1.20	7.65	8.21	8.69	8.03	8.58	9.05	8.40	8.94	9.41
1.30	7.75	8.39	8.96	8.12	8.76	9.32	8.49	9.12	9.67
				Cottonseed Meal—$60.00 per ton					
	7.31			**7.69**			**8.07**		
1.10	7.70	8.14	8.51	8.07	8.51	8.87	8.44	8.87	9.23
1.20	7.79	8.32	8.78	8.16	8.69	9.14	8.53	9.05	9.50
1.30	7.88	8.50	9.04	8.25	8.87	9.40	8.62	9.23	9.76
1.40	7.97	8.68	9.30	8.35	9.05	9.66	8.72	9.41	10.02
				Cottonseed Meal—$65.00 per ton					
	7.47			**7.85**			**8.23**		
1.20	7.93	8.43	8.86	8.30	8.80	9.22	8.67	9.16	9.58
1.30	8.02	8.61	9.12	8.39	8.98	9.48	8.76	9.34	9.84
1.40	8.11	8.79	9.38	8.48	9.16	9.74	8.85	9.52	10.10
1.50	8.20	8.97	9.65	8.57	9.34	10.01	8.95	9.70	10.37

TABLE 10—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $4.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$7.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$7.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$8.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
			Cottonseed Meal—$20.00 per ton						
	7.15			**7.53**			**7.91**		
.50	7.17	7.28	7.35	7.54	7.65	7.71	7.91	8.01	8.07
.60	7.26	7.46	7.62	7.63	7.83	7.98	8.01	8.19	8.35
.70	7.35	7.64	7.88	7.73	8.01	8.24	8.10	8.37	8.60
.80	7.45	7.82	8.14	7.82	8.19	8.50	8.19	8.55	8.86
			Cottonseed Meal—$25.00 per ton						
	7.31			**7.69**			**8.07**		
.50	7.31	7.39	7.44	7.68	7.75	7.80	8.05	8.12	8.16
.60	7.40	7.57	7.70	7.77	7.94	8.06	8.14	8.30	8.42
.70	7.49	7.75	7.96	7.86	8.12	8.32	8.23	8.48	8.68
.80	7.58	7.93	8.22	7.96	8.30	8.58	8.33	8.66	8.94
			Cottonseed Meal—$30.00 per ton						
	7.47			**7.85**			**8.24**		
.60	7.53	7.68	7.78	7.91	8.04	8.14	8.28	8.41	8.50
.70	7.63	7.86	8.04	8.00	8.22	8.40	8.37	8.59	8.76
.80	7.72	8.04	8.31	8.09	8.40	8.67	8.46	8.77	9.03
.90	7.81	8.22	8.57	8.18	8.58	8.93	8.55	8.95	9.29
			Cottonseed Meal—$35.00 per ton						
	7.64			**8.02**			**8.40**		
.60	7.67	7.79	7.87	8.04	8.15	8.22	8.41	8.52	8.58
.70	7.76	7.97	8.13	8.13	8.33	8.49	8.51	8.70	8.85
.80	7.86	8.15	8.39	8.23	8.51	8.75	8.60	8.88	9.11
.90	7.95	8.33	8.65	8.32	8.69	9.01	8.69	9.06	9.37
			Cottonseed Meal—$40.00 per ton						
	7.80			**8.18**			**8.56**		
.70	7.90	8.08	8.21	8.27	8.44	8.57	8.64	8.81	8.93
.80	7.99	8.26	8.47	8.36	8.62	8.83	8.73	8.99	9.19
.90	8.08	8.44	8.74	8.45	8.80	9.09	8.83	9.17	9.45
1.00	8.18	8.62	9.00	8.55	8.98	9.36	8.92	9.35	9.72
			Cottonseed Meal—$45.00 per ton						
	7.96			**8.34**			**8.72**		
.80	8.13	8.37	8.56	8.50	8.73	8.92	8.87	9.10	9.28
.90	8.22	8.55	8.82	8.59	8.91	9.18	8.96	9.28	9.54
1.00	8.31	8.73	9.08	8.68	9.09	9.44	9.05	9.46	9.80
1.10	8.40	8.91	9.34	8.78	9.27	9.70	9.15	9.64	10.06
			Cottonseed Meal—$50.00 per ton						
	8.13			**8.51**			**8.89**		
.90	8.35	8.66	8.90	8.73	9.02	9.26	9.10	9.39	9.62
1.00	8.45	8.84	9.16	8.82	9.20	9.52	9.19	9.57	9.88
1.10	8.54	9.02	9.43	8.91	9.38	9.79	9.28	9.75	10.15
1.20	8.63	9.20	9.69	9.00	9.56	10.05	9.37	9.93	10.41
			Cottonseed Meal—$55.00 per ton						
	8.29			**8.67**			**9.05**		
1.00	8.58	8.95	9.25	8.95	9.31	9.61	9.33	9.68	9.97
1.10	8.68	9.13	9.51	9.05	9.49	9.87	9.42	9.86	10.23
1.20	8.77	9.31	9.77	9.14	9.67	10.13	9.51	10.04	10.49
1.30	8.86	9.49	10.03	9.23	9.85	10.39	9.60	10.22	10.75
			Cottonseed Meal—$60.00 per ton						
	8.45			**8.83**			**9.21**		
1.10	8.81	9.24	9.59	9.18	9.60	9.95	9.55	9.96	10.31
1.20	8.90	9.42	9.85	9.28	9.78	10.21	9.65	10.14	10.57
1.30	9.00	9.60	10.12	9.37	9.96	10.48	9.74	10.32	10.84
1.40	9.09	9.78	10.38	9.46	10.14	10.74	9.83	10.51	11.10
			Cottonseed Meal—$65.00 per ton						
	8.61			**8.99**			**9.37**		
1.20	9.04	9.52	9.94	9.41	9.89	10.30	9.78	10.25	10.66
1.30	9.13	9.71	10.20	9.50	10.07	10.56	9.88	10.43	10.92
1.40	9.22	9.89	10.46	9.60	10.25	10.82	9.97	10.61	11.18
1.50	9.32	10.07	10.72	9.69	10.43	11.08	10.06	10.79	11.44

TABLE 11—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $5.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds.
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$5.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
				Cottonseed Meal—$20.00 per ton					
	6.30			**6.68**			**7.06**		
.50	6.30	6.40	6.45	6.67	6.76	6.81	7.04	7.13	7.16
.60	6.39	6.58	6.71	6.76	6.94	7.07	7.13	7.31	7.43
.70	6.48	6.76	6.97	6.86	7.12	7.33	7.23	7.49	7.69
.80	6.58	6.94	7.23	6.95	7.30	7.59	7.32	7.67	7.95
				Cottonseed Meal—$25.00 per ton					
	6.46			**6.84**			**7.23**		
.50	6.43	6.51	6.53	6.81	6.87	6.89	7.18	7.24	7.25
.60	6.53	6.69	6.79	6.90	7.05	7.15	7.27	7.42	7.51
.70	6.62	6.87	7.05	6.99	7.23	7.41	7.36	7.60	7.77
.80	6.71	7.05	7.32	7.08	7.41	7.67	7.45	7.78	8.03
				Cottonseed Meal—$30.00 per ton					
	6.63			**7.01**			**7.39**		
.60	6.66	6.80	6.87	7.03	7.16	7.23	7.41	7.53	7.59
.70	6.76	6.98	7.14	7.13	7.34	7.50	7.50	7.71	7.86
.80	6.85	7.16	7.40	7.22	7.52	7.76	7.59	7.89	8.12
.90	6.94	7.34	7.66	7.31	7.70	8.02	7.68	8.07	8.38
				Cottonseed Meal—$35.00 per ton					
	6.79			**7.17**			**7.55**		
.60	6.80	6.91	6.96	7.17	7.27	7.32	7.54	7.63	7.68
.70	6.89	7.09	7.22	7.26	7.45	7.58	7.63	7.81	7.94
.80	6.98	7.27	7.48	7.35	7.63	7.84	7.73	7.99	8.20
.90	7.08	7.45	7.74	7.45	7.81	8.10	7.82	8.18	8.46
				Cottonseed Meal—$40.00 per ton					
	6.95			**7.33**			**7.71**		
.70	7.03	7.19	7.30	7.40	7.56	7.66	7.77	7.92	8.02
.80	7.12	7.38	7.57	7.49	7.74	7.92	7.86	8.10	8.28
.90	7.21	7.56	7.83	7.58	7.92	8.19	7.95	8.28	8.55
1.00	7.30	7.74	8.09	7.68	8.10	8.45	8.05	8.46	8.81
				Cottonseed Meal—$45.00 per ton					
	7.12			**7.50**			**7.88**		
.80	7.26	7.48	7.65	7.63	7.85	8.01	8.00	8.21	8.37
.90	7.35	7.66	7.91	7.72	8.03	8.27	8.09	8.39	8.63
1.00	7.44	7.84	8.17	7.81	8.21	8.53	8.18	8.57	8.89
1.10	7.53	8.02	8.44	7.90	8.39	8.79	8.27	8.75	9.15
				Cottonseed Meal—$50.00 per ton					
	7.28			**7.66**			**8.04**		
.90	7.48	7.77	7.99	7.85	8.14	8.35	8.23	8.50	8.71
1.00	7.58	7.95	8.26	7.95	8.32	8.62	8.32	8.68	8.97
1.10	7.67	8.13	8.52	8.04	8.50	8.88	8.41	8.86	9.24
1.20	7.76	8.31	8.78	8.13	8.68	9.14	8.50	9.04	9.50
				Cottonseed Meal—$55.00 per ton					
	7.44			**7.82**			**8.20**		
1.00	7.71	8.06	8.34	8.08	8.43	8.70	8.45	8.79	**9.06**
1.10	7.80	8.24	8.60	8.18	8.61	8.96	8.55	8.97	9.32
1.20	7.90	8.42	8.86	8.27	8.79	9.22	8.64	9.15	9.58
1.30	7.99	8.60	9.13	8.36	8.97	9.49	8.73	9.33	9.84
				Cottonseed Meal—$60.00 per ton					
	7.60			**7.98**			**8.36**		
1.10	7.94	8.35	8.68	8.31	8.72	9.04	8.68	9.08	9.40
1.20	8.03	8.53	8.95	8.40	8.90	9.31	8.77	9.26	9.67
1.30	8.12	8.71	9.21	8.50	9.08	9.57	8.87	9.44	9.93
1.40	8.22	8.89	9.47	8.59	9.26	9.83	8.96	9.62	10.19
				Cottonseed Meal—$65.00 per ton					
	7.77			**8.15**			**8.53**		
1.20	8.17	8.64	9.03	8.54	9.01	9.39	8.91	9.37	9.75
1.30	8.26	8.82	9.29	8.63	9.19	9.65	9.00	9.55	10.01
1.40	8.35	9.00	9.55	8.72	9.37	9.91	9.10	9.73	10.27
1.50	8.45	9.18	9.82	8.82	9.55	10.18	9.19	9.91	10.54

TABLE 12—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $5.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds.
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$7.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$7.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$8.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
			Cottonseed Meal—$20.00 per ton						
	7.44			**7.82**			**8.20**		
.50	7.41	7.49	7.52	7.78	7.86	7.88	8.16	8.22	8.24
.60	7.51	7.67	7.79	7.88	8.04	8.15	8.25	8.40	8.50
.70	7.60	7.85	8.05	7.97	8.22	8.41	8.34	8.58	8.77
.80	7.69	8.03	8.31	8.06	8.40	8.67	8.43	8.76	9.03
			Cottonseed Meal—$25.00 per ton						
	7.61			**7.99**			**8.37**		
.50	7.55	7.60	7.61	7.92	7.96	7.97	8.29	8.33	8.33
.60	7.64	7.78	7.87	8.01	8.15	8.23	8.38	8.51	8.59
.70	7.73	7.96	8.13	8.10	8.33	8.49	8.48	8.69	8.85
.80	7.83	8.14	8.39	8.20	8.51	8.75	8.57	8.87	9.11
			Cottonseed Meal—$30.00 per ton						
	7.77			**8.15**			**8.53**		
.60	7.78	7.89	7.95	8.15	8.25	8.31	8.52	8.62	8.67
.70	7.87	8.07	8.21	8.24	8.43	8.57	8.61	8.80	8.93
.80	7.96	8.25	8.48	8.33	8.61	8.84	8.70	8.98	9.20
.90	8.05	8.43	8.74	8.43	8.80	9.10	8.80	9.16	9.46
			Cottonseed Meal—$35.00 per ton						
	7.93			**8.31**			**8.69**		
.60	7.91	8.00	8.04	8.28	8.36	8.39	8.66	8.73	8.75
.70	8.01	8.18	8.30	8.38	8.54	8.66	8.75	8.91	9.02
.80	8.10	8.36	8.56	8.47	8.72	8.92	8.84	9.09	9.28
.90	8.19	8.54	8.82	8.56	8.90	9.18	8.93	9.27	9.54
			Cottonseed Meal—$40.00 per ton						
	8.09			**8.47**			**8.85**		
.70	8.14	8.29	8.38	8.51	8.65	8.74	8.88	9.02	9.10
.80	8.23	8.47	8.64	8.60	8.83	9.00	8.98	9.20	9.36
.90	8.33	8.65	8.91	8.70	9.01	9.26	9.07	9.38	9.62
1.00	8.42	8.83	9.17	8.79	9.19	9.53	9.16	9.56	9.89
			Cottonseed Meal—$45.00 per ton						
	8.26			**8.64**			**9.02**		
.80	8.37	8.58	8.73	8.74	8.94	9.09	9.11	9.31	9.44
.90	8.46	8.76	8.99	8.83	9.12	9.35	9.20	9.49	8.71
1.00	8.55	8.94	9.25	8.93	9.30	9.61	9.30	9.67	9.97
1.10	8.65	9.12	9.51	9.02	9.48	9.87	9.39	9.85	10.23
			Cottonseed Meal—$50.00 per ton						
	8.42			**8.80**			**9.18**		
.90	8.60	8.87	9.07	8.97	9.23	9.43	9.34	9.60	9.79
1.00	8.69	9.05	9.33	9.06	9.41	9.69	9.43	9.78	10.05
1.10	8,78	9.23	9.60	9.15	9.59	9.96	9.52	9.96	10.31
1.20	8,87	9.41	9.86	9.25	9.77	10.22	9.62	10.14	10.58
			Cottonseed Meal—$55.00 per ton						
	8.58			**8.96**			**9.34**		
1.00	8.83	9.16	9.42	9.20	9.52	9.78	9.57	9.89	10.14
1.10	8.92	9.34	9.68	9.29	9.70	10.04	9.66	10.07	10.40
1.20	9.01	9.52	9.94	9.38	9.88	10.30	9.75	10.25	10.66
1.30	9.10	9.70	10.20	9.47	10.06	10.56	9.85	10.43	10.92
			Cottonseed Meal—$60.00 per ton						
	8.74			**9.12**			**9.50**		
1.10	9.05	9.45	9.76	9.42	9.81	10.12	9.80	10.17	10.48
1.20	9.15	9.63	10.02	9.52	9.99	10.38	9.89	10.35	10.74
1.30	9.24	9.80	10.29	9.61	10.17	10.65	9.98	10.54	11.01
1.40	9.33	9.99	10.55	9.70	10.35	10.91	10.07	10.72	11.27
			Cottonseed Meal—$65.00 per ton						
	8.91			**9.29**			**9.67**		
1.20	9.28	9.74	10.11	9.65	10.10	10.47	10.02	10.46	10.83
1.30	9.37	9.92	10.37	9.75	10.28	10.73	10.12	10.64	11.09
1.40	9.47	10.10	10.63	9.84	10.46	10.99	10.21	10.82	11.35
1.50	9.56	10.28	10.89	9.93	10.64	11.25	10.30	11.00	11.61

TABLE 13—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $6.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds.
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$5.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$6.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
				Cottonseed Meal—$20.00 per ton					
	6.60			**6.98**			**7.36**		
.50	6.54	6.61	6.62	6.91	6.97	6.97	7.28	7.34	7.33
.60	6.63	6.79	6.88	7.01	7.15	7.24	7.38	7.52	7.60
.70	6.73	6.97	7.14	7.10	7.33	7.50	7.47	7.70	7.86
.80	6.82	7.15	7.40	7.19	7.51	7.76	7.56	7.88	8.12
				Cottonseed Meal—$25.00 per ton					
	6.76			**7.14**			**7.52**		
.50	6.68	6.72	6.70	7.05	7.08	7.06	7.42	7.45	7.42
.60	6.77	6.90	6.96	7.14	7.26	7.32	7.51	7.63	7.68
.70	6.86	7.08	7.22	7.23	7.44	7.58	7.60	7.81	7.94
.80	6.95	7.26	7.49	7.33	7.62	7.84	7.70	7.99	8.20
				Cottonseed Meal—$30.00 per ton					
	6.92			**7.30**			**7.68**		
.60	6.91	7.01	7.04	7.28	7.37	7.40	7.65	7.74	7.76
.70	7.00	7.19	7.31	7.37	7.55	7.67	7.74	7.92	8.03
.80	7.09	7.37	7.57	7.46	7.73	7.93	7.83	8.10	8.29
.90	7.18	7.55	7.83	7.55	7.91	8.19	7.93	8.28	8.55
				Cottonseed Meal—$35.00 per ton					
	7.08			**7.46**			**7.84**		
.60	7.04	7.12	7.13	7.41	7.48	7.49	7.78	7.84	7.85
.70	7.13	7.30	7.39	7.50	7.66	7.75	7.88	8.02	8.11
.80	7.23	7.48	7.65	7.60	7.84	8.01	7.97	8.21	8.37
.90	7.32	7.66	7.91	7.69	8.02	8.27	8.06	8.39	8.63
				Cottonseed Meal—$40.00 per ton					
	7.25			**7.63**			**8.01**		
.70	7.27	7.41	7.47	7.64	7.77	7.83	8.01	8.13	8.19
.80	7.36	7.59	7.74	7.73	7.95	8.09	8.10	8.31	8.45
.90	7.45	7.77	8.00	7.83	8.13	8.36	8.20	8.49	8.72
1.00	7.55	7.95	8.26	7.92	8.31	8.62	8.29	8.67	8.98
				Cottonseed Meal—$45.00 per ton					
	7.41			**7.79**			**8.17**		
.80	7.50	7.69	7.82	7.87	8.06	8.18	8.24	8.42	8.54
.90	7.59	7.87	8.08	7.96	8.24	8.44	8.33	8.60	8.80
1.00	7.68	8.05	8.34	8.05	8.42	8.70	8.42	8.78	9.06
1.10	7.77	8.24	8.60	8.15	8.60	8.96	8.52	8.96	9.32
				Cottonseed Meal—$50.00 per ton					
	7.57			**7.95**			**8.33**		
.90	7.73	7.98	8.16	8.10	8.35	8.52	8.47	8.71	8.88
1.00	7.82	8.16	8.43	8.19	8.53	8.79	8.56	8.89	9.14
1.10	7.91	8.34	8.69	8.28	8.71	9.05	8.65	9.07	9.41
1.20	8.00	8.52	8.95	8.37	8.89	9.31	8.75	9.25	9.67
				Cottonseed Meal—$55.00 per ton					
	7.73			**8.11**			**8.49**		
1.00	7.95	8.27	8.51	8.32	8.64	8.87	8.70	9.00	9.23
1.10	8.05	8.45	8.77	8.42	8.82	9.13	8.79	9.18	9.49
1.20	8.14	8.63	9.03	8.51	9.00	9.39	8.88	9.36	9.75
1.30	8.23	8.81	9.30	8.60	9.18	9.66	8.97	9.54	10.01
				Cottonseed Meal—$60.00 per ton					
	7.90			**8.28**			**8.66**		
1.10	8.18	8.56	8.85	8.55	8.93	9.21	8.92	9.29	9.57
1.20	8.27	8.74	9.12	8.65	9.11	9.48	9.02	9.47	9.84
1.30	8.37	8.92	8.38	8.74	9.29	9.74	9.11	9.65	10.10
1.40	8.46	9.10	9.64	8.83	9.47	10.00	9.20	9.83	10.36
				Cottonseed Meal—$65.00 per ton					
	8.06			**8.44**			**8.82**		
1.20	8.41	8.85	9.20	8.78	9.22	9.56	9.15	9.58	9.92
1.30	8.50	9.03	9.46	8.87	9.40	9.82	9.24	9.76	10.18
1.40	8.59	9.21	9.72	8.97	9.58	10.08	9.34	9.94	10.44
1.50	8.69	9.39	9.99	9.06	9.76	10.35	9.43	10.12	10.71

TABLE 14—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED—SILAGE $6.00 PER TON

Figures in black type show necessary selling price of steers not receiving molasses

Age—Yearlings and two year olds. Average initial weight—771 pounds.
Quality—Good to choice. Average length of feeding period—122 days.

Corn per Bushel $	Feeders—$7.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$7.50 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage	Feeders—$8.00 per cwt. C.S.M., Light Corn, Silage	C.S.M., Medium Corn, Silage	C.S.M., Heavy Corn, Silage
				Cottonseed Meal—$20.00 per ton					
	7.74			**8.12**			**8.50**		
.50	7.66	7.70	7.69	8.03	8.07	8.05	8.40	8.43	8.41
.60	7.75	7.88	7.96	8.12	8.25	8.32	8.49	8.61	8.67
.70	7.84	8.06	8.22	8.21	8.43	8.58	8.58	8.79	8.94
.80	7.93	8.24	8.48	8.30	8.61	8.84	8.68	8.97	9.20
				Cottonseed Meal—$25.00 per ton					
	7.90			**8.28**			**8.66**		
.50	7.79	7.81	7.78	8.16	8.18	8.14	8.55	8.54	8.50
.60	7.88	7.99	8.04	8.25	8.36	8.40	8.63	8.72	8.76
.70	7.98	8.17	8.30	8.35	8.54	8.66	8.72	8.90	9.02
.80	8.07	8.35	8.56	8.44	8.72	8.92	8.81	9.08	9.28
				Cottonseed Meal—$30.00 per ton					
	8.06			**8.44**			**8.82**		
.60	8.02	8.10	8.12	8.39	8.46	8.48	8.76	8.83	8.84
.70	8.11	8.28	8.38	8.48	8.64	8.74	8.85	9.01	9.10
.80	8.20	8.46	8.65	8.58	8.83	9.01	8.95	9.19	9.37
.90	8.30	8.64	8.91	8.67	9.01	9.27	9.04	9.37	9.63
				Cottonseed Meal—$35.00 per ton					
	8.22			**8.60**			**8.99**		
.60	8.15	8.21	8.21	8.53	8.57	8.56	8.90	8.94	8.92
.70	8.25	8.39	8.47	8.62	8.75	8.83	8.99	9.12	9.19
.80	8.34	8.57	8.73	8.71	8.93	9.09	9.08	9.30	9.45
.90	8.43	8.75	8.99	8.80	9.11	9.35	9.17	9.48	9.71
				Cottonseed Meal—$40.00 per ton					
	8.39			**8.77**			**9.15**		
.70	8.38	8.50	8.55	8.75	8.86	8.91	9.13	9.23	9.27
.80	8.48	8.68	8.81	8.85	9.04	9.17	9.22	9.41	9.53
.90	8.57	8.86	9.08	8.94	9.22	9.43	9.31	9.59	9.79
1.00	8.66	9.04	9.34	9.03	9.40	9.70	9.40	9.77	10.06
				Cottonseed Meal—$45.00 per ton					
	8.55			**8.93**			**9.31**		
.80	8.61	8.79	8.90	8.98	9.15	9.26	9.35	9.52	9.61
.90	8.70	8.97	9.16	9.07	9.33	9.52	9.45	9.70	9.88
1.00	8.80	9.15	9.42	9.17	9.51	9.78	9.54	9.88	10.14
1.10	8.89	9.33	9.68	9.26	9.69	10.04	9.63	10.06	10.40
				Cottonseed Meal—$50.00 per ton					
	8.71			**9.09**			**9.47**		
.90	8.84	9.08	9.24	9.21	9.44	9.60	9.58	9.81	9.96
1.00	8.93	9.26	9.50	9.30	9.62	9.86	9.67	9.99	10.22
1.10	9.02	9.44	9.77	9.40	9.80	10.13	9.77	10.17	10.48
1.20	9.12	9.62	10.03	9.49	9.98	10.39	9.86	10.35	10.75
				Cottonseed Meal—$55.00 per ton					
	8.88			**9.26**			**9.64**		
1.00	9.07	9.37	9.59	9.44	9.73	9.95	9.81	10.10	10.31
1.10	9.16	9.55	9.85	9.53	9.91	10.21	9.90	10.28	10.57
1.20	9.25	9.73	10.11	9.62	10.09	10.47	9.99	10.46	10.83
1.30	9.34	9.91	10.37	9.72	10.27	10.73	10.09	10.64	11.09
				Cottonseed Meal—$60.00 per ton					
	9.04			**9.42**			**9.80**		
1.10	9.30	9.66	9.93	9.67	10.02	10.29	10.04	10.38	10.65
1.20	9.39	9.84	10.19	9.76	10.20	10.55	10.13	10.57	10.91
1.30	9.48	10.02	10.46	9.85	10.38	10.82	10.22	10.75	11.18
1.40	9.57	10.20	10.72	9.94	10.56	11.08	10.32	10.93	11.44
				Cottonseed Meal—$65.00 per ton					
	9.20			**9.58**			**9.96**		
1.20	9.52	9.95	10.28	9.89	10.31	10.64	10.27	10.67	11.00
1.30	9.62	10.13	10.54	9.99	10.49	10.90	10.36	10.85	11.26
1.40	9.71	10.31	10.80	10.08	10.67	11.16	10.45	11.03	11.52
1.50	9.80	10.49	11.06	10.17	10.85	11.42	10.54	11.21	11.78

TABLE 15—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED

Based on work at Mississippi, North Carolina, South Carolina, Alabama, and Tennessee Stations and the United States Department of Agriculture

Number of steers used—131 Average ration— { Cottonseed meal—6.8 pounds; Corn silage—42.1 pounds }

Silage Per ton	Cost of Feeders per cwt.						
$	$4.00	$4.50	$5.00	$5.50	$6.00	$6.50	$7.00
			Cottonseed Meal—$20.00 per ton				
3.00	4.68	5.09	5.50	5.92	6.33	6.74	7.16
4.00	4.89	5.30	5.72	6.13	6.54	6.96	7.37
5.00	5.11	5.52	5.93	6.35	6.76	7.17	7.59
6.00	5.32	5.73	6.15	6.56	6.97	7.39	7.80
			Cottonseed Meal—$25.00 per ton				
3.00	4.86	5.27	5.68	6.10	6.51	6.92	7.34
4.00	5.07	5.49	5.90	6.31	6.73	7.14	7.55
5.00	5.29	5.70	6.11	6.53	6.94	7.35	7.77
6.00	5.50	5.91	6.33	6.74	7.15	7.57	7.98
			Cottonseed Meal—$30.00 per ton				
3.00	5.04	5.45	5.86	6.28	6.69	7.10	7.52
4.00	5.25	5.67	6.08	6.49	6.91	7.32	7.73
5.00	5.47	5.88	6.29	6.71	7.12	7.53	7.95
6.00	5.68	6.10	6.51	6.92	7.34	7.75	8.16
			Cottonseed Meal—$35.00 per ton				
3.00	5.22	5.63	6.05	6.46	6.87	7.29	7.70
4.00	5.43	5.85	6.26	6.67	7.09	7.50	7.91
5.00	5.65	6.06	6.48	6.89	7.30	7.72	8.13
6.00	5.86	6.28	6.69	7.10	7.52	7.93	8.34
			Cottonseed Meal—$40.00 per ton				
4.00	5.61	6.03	6.44	6.85	7.27	7.68	8.09
5.00	5.83	6.24	6.66	7.07	7.48	7.89	8.31
6.00	6.04	6.46	6.87	7.28	7.70	8.11	8.52
7.00	6.26	6.67	7.08	7.50	7.91	8.32	8.74
			Cottonseed Meal—$45.00 per ton				
4.00	5.79	6.21	6.62	7.03	7.45	7.86	8.27
5.00	6.01	6.42	6,84	7.25	7.66	8.08	8.49
6.00	6.22	6.64	7.05	7.46	7.88	8.29	8.70
7.00	6.44	6.85	7.27	7.68	8.09	8.51	8.92
			Cottonseed Meal—$50.00 per ton				
4.00	5.98	6.39	6.80	7.22	7.63	8.04	8.46
5.00	6.19	6.60	7.02	7.43	7.84	8.26	8.67
6.00	6.41	6.82	7.23	7.65	8.06	8.47	8.89
7.00	6.62	7.03	7.45	7.86	8.27	8.69	9.10
			Cottonseed Meal—$55.00 per ton				
4.00	6.16	6.57	6.98	7.40	7.81	8.22	8.64
5.00	6.37	6.79	7.20	7.61	8.03	8.44	8.85
6.00	6.59	7.00	7.41	7.83	8.24	8.65	9.07
7.00	6.80	7.22	7.63	8.04	8.46	8.87	9.28
			Cottonseed Meal—$60.00 per ton				
4.00	6.34	6.75	7.17	7.58	7.99	8.40	8.82
5.00	6.55	6.97	7.38	7.79	8.21	8.62	9.03
6.00	6.77	7.18	7.59	8.01	8.42	8.83	9.25
7.00	6.98	7.40	7.81	8.22	8.64	9.05	9.46
			Cottonseed Meal—$65.00 per ton				
5.00	6.73	7.15	7.56	7.97	8.39	8.80	9.21
6.00	6.95	7.36	7.78	8.19	8.60	9.02	9.43
7.00	7.16	7.58	7.99	8.40	8.82	9.23	9.64
8.00	7.38	7.79	8.21	8.62	9.03	9.45	9.86

TABLE 16—SELLING PRICE OF STEERS ON FARM NECESSARY TO PAY FOR CATTLE AND FEED

Based on work at Mississippi, North Carolina, South Carolina, Alabama, and Tennessee Stations and the United States Department of Agriculture

Number of steers used—141 Average ration— Cottonseed meal—6.8 pounds; Cottonseed hulls—25.6 pounds

Cottonseed hulls per ton	Cost of Feeders per cwt.						
$	$4.00	$4.50	$5.00	$5.50	$6.00	$6.50	$7.00
		Cottonseed Meal—$20.00 per ton					
4.00	4.58	5.00	5.42	5.84	6.27	6.69	7.11
6.00	4.84	5.26	5.68	6.10	6.52	6.94	7.37
8.00	5.10	5.52	5.94	6.36	6.78	7.20	7.62
10.00	5.35	5.77	6.19	6.62	7.04	7.46	7.88
		Cottonseed Meal—$25.00 per ton					
4.00	4.76	5.18	5.60	6.02	6.44	6.86	7.28
6.00	5.01	5.43	5.85	6.28	6.70	7.12	7.54
8.00	5.27	5.69	6.11	6.53	6.95	7.38	7.80
10.00	5.53	5.95	6.37	6.79	7.21	7.63	8.05
		Cottonseed Meal—$30.00 per ton					
6.00	5.19	5.61	6.03	6.45	6.87	7.29	7.71
8.00	5.44	5.87	6.29	6.71	7.13	7.55	7.97
10.00	5.70	6.12	6.54	6.96	7.39	7.81	8.23
12.00	5.96	6.38	6.80	7.22	7.64	8.06	8.49
		Cottonseed Meal—$35.00 per ton					
6.00	5.36	5.78	6.20	6.62	7.05	7.47	7.89
8.00	5.62	6.04	6.46	6.88	7.30	7.72	8.15
10.00	5.88	6.30	6.72	7.14	7.56	7.98	8.40
12.00	6.13	6.55	6.97	7.40	7.82	8.24	8.66
		Cottonseed Meal—$40.00 per ton					
8.00	5.79	6.21	6.63	7.06	7.48	7.90	8.32
10.00	6.05	6.47	6.89	7.31	7.73	8.16	8.58
12.00	6.31	6.73	7.15	7.57	7.99	8.41	8.83
14.00	6.56	6.98	7.41	7.83	8.25	8.67	9.09
		Cottonseed Meal—$45.00 per ton					
10.00	6.22	6.65	7.07	7.49	7.91	8.33	8.75
12.00	6.48	6.90	7.32	7.74	8.17	8.59	9.01
14.00	6.74	7.16	7.58	8.00	8.42	8.84	9.27
16.00	7.00	7.42	7.84	8.26	8.68	9.10	9.52
		Cottonseed Meal—$50.00 per ton					
12.00	6.66	7.08	7.50	7.92	8.34	8.76	9.18
14.00	6.91	7.33	7.75	8.18	8.60	9.02	9.44
16.00	7.17	7.59	8.01	8.43	8.85	9.28	9.70
18.00	7.43	7.85	8.27	8.69	9.11	9.53	9.95
		Cottonseed Meal—$55.00 per ton					
12.00	6.83	7.25	7.67	8.09	8.51	8.94	9.36
14.00	7.09	7.51	7.93	8.35	8.77	9.19	9.61
16.00	7.34	7.76	8.19	8.61	9.03	9.45	9.87
18.00	7.60	8.02	8.44	8.86	9.29	9.71	10.13
		Cottonseed Meal—$60.00 per ton					
14.00	7.26	7.68	8.10	8.52	8.95	9.37	9.79
16.00	7.52	7.94	8.36	8.78	9.20	9.62	10.05
18.00	7.78	8.20	8.62	9.04	9.46	9.88	10.30
20.00	8.03	8.45	8.87	9.30	9.72	10.14	10.56
		Cottonseed Meal—$65.00 per ton					
14.00	7.44	7.86	8.28	8.70	9.12	9.54	9.96
16.00	7.69	8.11	8.53	8.96	9.38	9.80	10.22
18.00	7.95	8.37	8.79	9.21	9.63	10.06	10.48
20.00	8.21	8.63	9.05	9.47	9.89	10.31	10.73

BULLETIN No. 243—1927

PROGRESS REPORT

ON

COST OF PRODUCTION ROUTE IN CHOCTAW COUNTY, MISSISSIPPI, 1926

By

LEWIS E. LONG, Research Economist

and

H. W. REYNOLDS, Route Man

United States Department of Agriculture

Bureau of Agricultural Economics

In Cooperation With

Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. RICKS, Director

PROGRESS REPORT

ON

COST OF PRODUCTION ROUTE IN CHOCTAW COUNTY, MISSISSIPPI, 1926

This is the third annual report on this study. Data for the calendar years 1924 and 1925 are contained in Mississippi Station Bulletins 228 and 237 respectively.

Records from nineteen farms*, designated by numbers 1 to 19, are contained in this report. Each farm carries the same number throughout.

The growing season was favorable for practically all crops. Yields per acre of cotton, corn and hay showed an increase over both preceding years, while the oat yield was better than that of 1925, but not so good as in 1924. The unfavorable conditions for feed crops which existed in 1925 brought about a marked reduction of acreage in oats and hay in 1926. Fewer crops of cane and sorghum were grown in 1926 for the same reason.

Low prices for cotton materially affected the financial receipts on some of the farms, but the majority of farms, because of small acreages, were able to pick and market the crop before the entire price decline had taken place.

Publication of a bulletin following this report will complete the study.

TABLE 1 FINANCIAL STATEMENT
Arrayed on Percent Return on Investment
19 Farms, Choctaw Co. Miss.—1926

Farm No.	Total Investment	Crop and Livestock Receipts	Miscellaneous Receipts 1/	Increase in Inventory	Value Items Furnished the Home	Total Value of Products
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1	3580	778.12	52.55	492.00	458.83	1781.50
2	1641	646.56	83.10	49.10	363.57	1142.33
3	3067	502.59	294.1[illegible]	[illegible]	545.38	1342.14
4	3259	826.64	154.00	372.95	324.16	1677.75
5	3697	997.59	220.80	326.95	597.59	2142.93
6	2801	347.34	256.45	109.75	345.11	1058.65
7	4639	367.45	669.50	[illegible]	611.42	1648.37
8	5679	613.17	[illegible]	[illegible]	718.75	1331.92
9	2992	445.76	104.86		354.58	905.20
10	9282	2711.06	[illegible]		366.43	3077.49
11	4328	719.75	376.50	[illegible]	477.74	1573.99
12	5670	552.35	480.65	[illegible]	406.87	1439.87
13	8084	330.35	749.04	767.03	816.79	2663.21
14	3678	948.70	396.50	111.09	485.10	1941.39
15	2514	293.63	45.00	[illegible]	282.90	621.53
16	3664	327.17	89.20	492.35	360.24	1268.96
17	3972	390.86	122.45	[illegible]	429.89	943.20
18	4007	603.53	52.20	[illegible]	458.99	1114.72
19	3790	496.58	346.35	218.85	621.37	1593.15
Average	4229	674.17	236.49	154.74	475.04	1540.44

1/ Includes Labor off the farm.

* The farmers cooperating were G. W. Blaine, W. W. Bond, C. W. Coleman, F. S. Coleman, F. T. Coleman, J. E. Drane, R. H. Henderson, J. E. Keene, Alvin King, B. F. King, H. D. King, R. S. King, W. H. King, R. J. McKnight, J. H. Prewitt, T. M. Pyron, E. B. Smith, J. M. Smith, and M. E. Worrell.

TABLE 1 (Continued)

Cash Expenses	Decrease in Inventory	Value of Family Labor	Total Charge	Farm Income	Value of Operator's Labor	Return on Investment 2/
Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Per Cent
617.50		58.80	676.30	1105.20	348.22	21.1
482.35		19.05	501.40	640.93	297.90	20.9
307.52	117.25	7.50	432.27	909.87	289.58	20.2
570.23		277.80	848.03	829.72	251.13	17.8
886.89		409.50	1296.39	846.54	262.35	15.8
332.45		9.75	342.20	716.45	280.05	15.6
340.20	52.25	354.00	746.45	901.92	254.92	13.9
359.27	35.00	7.20	401.47	930.45	244.20	12.1
355.88	42.20	14.25	412.33	492.87	156.00	11.3
1478.23	96.90	67.50 3/	1651.63	1425.86	394.57	11.1
331.52	218.35	179.85	729.72	844.27	363.60	11.1
398.18	105.15	22.50	525.83	914.04	335.18	10.2
1629.06			1629.06	1034.15	327.67	8.7
865.62		603.90	1469.52	471.87	158.88	8.5
180.87	88.15		296.02	352.51	158.25	7.7
744.42		5.55	749.97	518.99	273.98	6.7
270.14	190.70		460.84	482.36	277.05	5.2
230.62	204.00	325.12	759.74	354.98	298.50	1.4
653.81		588.60	1242.41	350.74	395.47	-1.2
581.25	60.52	155.31	797.08	743.35	282.50	10.9 4/

2/ The difference between farm income and value of operator's labor multiplied by 100 and the result divided by Total Investment.

3/ Board furnished labor.

4/ Average weighted.

Table 1 shows the investment, receipts, expenses, and return on investment after deducting 15c per hour for the operator's labor.

As may be seen, the return on investment depends directly on the size of investment and the difference between receipts and expenses, and indirectly on the items making up the receipts and expenses. The greater the difference between these two items, other things being equal, the greater will be the return. The secret of good management lies in so balancing the different parts of the farm business that each part will return something more than what is put into it. This involves, not only the optimum acreages of the several crops and pasture, and the most profitable numbers of livestock, but also the judicious use of available man labor, horse work, machinery, and fertilizer.

The rates of return for the 19 farms range from 21.1 per cent to —1.2 per cent. Some of the reasons for this variation should be of interest. For comparison, let us take farms No. 5 and 14 having almost the same investment, but the one returning 15.8 per cent and the other 8.5 per cent.

Crop and livestock receipts were about equal for the two farms—No. 5 being slightly higher. Subsequent tables show Farm 5 to have 26.1 acres of cotton and 13.8 acres of corn in addition to the garden and truck crops. Corresponding acreages for Farm 14 were 30.3 and 5.9. Farm 5 kept 3 head of workstock, 2 milk cows, and 35 chickens, and produced 960 pounds of dressed pork as compared to 3 head of workstock, 3 milk cows, 34 chickens and 645 pounds of dressed pork for Farm 14.

The value of items furnished the home is a fair measure of the fitness of the crop and livestock adaptibility to the farm since the items include garden vegetables, potatoes, syrup, meal, meat, milk, eggs, and fuel. The value of such items supplied by Farm 5 was $597.59 as compared to $485.10 by Farm 14.

Cost of labor is usually the largest item entering into the costs of farm products. Efficient use of labor, therefore, usually means a larger income. Man labor was all valued at 15c per hour. The respective costs for man labor per acre of cotton (Table 2) on Farms 5 and 14 were $12.02 and $18.91, while similar costs on corn (Table 5) were $8.62 and $9.09. Since the same hour rate was used for both, it is evident that Farm 14 devoted more hours per acre to each crop than Farm 5. Values for Family and Operator Labor also indicate that perhaps the labor on Farm 5 was handled more effectively.

Cost of horse work varied on different farms as shown by Table 9. Efficient use of this item involves a low cost of keeping workstock and a large amount of work performed. The costs per hour of horse work (Table 9) amounted to 9.5c for Farm 5 and 15.2c for Farm 14. Farm 5 had a slightly higher net cost per head for keeping workstock, but obtained nearly twice as much work per head.

In the use of fertilizer, Farm 5 spent more per acre on cotton, but less on corn than did Farm 14. Table 4 shows the kinds and amounts of fertilizers used.

TABLE 2. COTTON—Cost per Acre and per Pound Lint
Arrayed on Cost of Producing Lint
18 Farms—Choctaw County—1926

Farm No.	A. per Farm	Man Labor	Horse Work	Fert-ilizers	Gin-ning	Other Costs 1/	Gross Costs 2/	Seed Credit	Net Cost	Cost per lb. Lint
	No.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Cents
16	2.1	20.46	8.88	5.72	4.76	2.86	37.68	12.86	24.82	5.2
12	9.9	8.67	2.75	2.74	1.63	1.05	16.84	4.52	12.32	5.3
13	5.2	10.75	5.43	3.69	4.13	2.05	26.05	7.69	18.36	5.8
6	6.5	15.84	4.60	6.52	2.64	2.43	32.03	8.62	23.41	6.2
3	11.8	7.45	3.45	5.31	2.12	1.23	19.56	4.40	15.16	6.9
17	7.0	11.73	3.99	4.66	2.57	3.32	26.27	5.71	20.56	7.6
9	14.0	6.89	3.33	1.85	1.30	.79	14.07	3.20	10.87	8.4
4	18.2	13.62	6.07	4.50	2.86	2.75	29.80	6.59	23.21	8.4
2	13.0	14.14	5.36	4.69	2.83	2.24	29.26	5.35	23.91	8.7
5	26.1	12.02	2.82	3.01	1.92	1.42	21.19	4.50	16.69	9.0
15	2.5	15.72	10.15	7.67	4.04	1.75	39.33	8.64	30.69	9.4
1	5.1	18.68	6.04	6.07	2.94	2.60	36.33	5.88	30.45	10.6
8	1.5	40.70	8.68	13.20	6.00	2.74	71.32	11.20	60.12	10.8
7	13.2	20.05	7.41	2.89	2.65	2.54	35.54	6.45	29.09	10.9
19	23.5	15.75	5.40	2.13	1.80	1.91	26.99	3.98	23.01	11.7
11	11.7	21.52	5.64	5.41	2.48	3.48	38.53	6.73	31.80	12.0
18	12.0	22.95	7.52	4.14	2.50	1.27	38.38	5.27	33.11	13.2
14	30.3	18.91	3.60	2.49	1.27	.98	27.25	3.00	24.25	14.9
						Weighted Average				
	11.9	15.12	4.79	3.69	2.22	1.85	27.67	5.11	22.56	9.7

1/ Machinery use charge at two cents per hour, and seed.
2/ Exclusive of charge for use of land.

Table 2 shows the cost of producing lint cotton while Table 3 shows the distribution of man labor and horse work by operations. Where each

enterprise of the farm is on a paying basis, the farm business as a whole must pay.

Costs per pound of lint ranged from 5.2c to 14.9c on the 18 farms growing wage cotton. Reasons for this variation may be better seen by comparing cost items on two farms. For this purpose, take Farms 13 and 1 which had about an equal acreage in cotton. Farm 13 had lower costs for man labor, horse work, fertilizer, and "other costs". It had a higher ginning charge because of a larger yield and a higher seed credit for the same reason.

TABLE 3. COTTON—Man Labor and Horse Work by Operations Arrayed on Cost of Producing Lint

Man Labor per Acre

Farm No.	A. per Farm	Land Prep-aration	Ap'ly'g Fert.	Har'w and Plant	Culti-vate	Hoe & Chop	Pick	Haul to Gin	Total	Yield Lint
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Lbs.
16	2.1	5.7	3.8	11.4	19.3	17.1	78.1	1.0	136.4	476
12	9.9	4.0	1.8	2.3	9.8	13.0	24.9	2.0	57.8	232
13	5.2	2.7	1.2	2.8	15.6	14.4	32.1	2.9	71.7	318
6	6.5	5.5	2.0	5.2	15.9	24.6	49.2	3.2	105.6	377
3	11.8	3.6	1.2	2.7	10.0	6.5	24.5	1.2	49.7	220
17	7.0	7.7	2.0	2.9	22.6	12.1	29.8	1.1	78.2	269
9	14.0	2.8	1.2	1.8	8.6	17.7	11.8	1.4	45.3	130
4	18.2	9.5	2.5	4.2	13.4	27.6	30.6	3.0	90.8	276
2	13.0	7.2	2.7	3.8	18.7	20.2	39.1	2.6	94.3	274
5	26.1	9.0	2.0	3.5	14.3	21.4	28.6	1.3	80.1	186
15	2.5	7.6	3.2	2.8	14.0	17.2	57.6	2.4	104.8	326
1	5.1	12.9	6.3	6.9	19.0	13.5	62.0	3.9	124.5	288
8	1.5	21.3	5.3	16.0	8.7	42.7	172.0	5.3	271.3	555
7	13.2	13.4	3.9	6.5	25.7	36.7	43.5	4.0	133.7	267
19	23.5	11.7	2.6	3.7	15.1	17.5	51.1	3.3	105.0	197
11	11.7	10.6	4.9	6.9	24.1	40.4	52.8	3.8	143.5	264
18	12.0	9.6	5.5	5.5	21.8	50.4	57.0	3.2	153.0	250
14	30.3	6.8	2.3	2.8	11.0	45.0	56.7	1.5	126.1	163
					Weighted Average					
	11.9	8.2	2.7	4.1	15.4	26.4	41.6	2.4	100.8	232
					Horse Work per Acre					
16	2.1	11.4	3.8	11.4	19.3			2.0	47.9	476
12	9.9	4.5	2.3	2.0	9.8			4.1	22.7	232
13	5.2	3.8		2.8	18.3			5.8	30.7	318
6	6.5	7.5		5.2	15.9			6.5	35.1	377
3	11.8	4.5		2.7	10.0			2.4	19.6	220
17	7.0	9.9		2.9	22.6			2.2	37.6	269
9	14.0	4.7		1.8	8.6			2.9	18.0	130
4	18.2	10.3	.3	4.2	13.4			6.1	34.3	276
2	13.0	9.3		3.8	18.7			5.2	37.0	274
5	26.1	9.3		3.5	14.3			2.6	29.7	186
15	2.5	13.2	1.6	4.0	14.0			4.8	37.6	326
1	5.1	17.5	3.7	5.9	20.0			7.8	54.9	288
8	1.5	21.3	5.3	16.0	8.7			10.7	62.0	555
7	13.2	14.4	.9	5.8	25.7			5.0	51.8	267
19	23.5	11.7	2.2	3.7	15.2			4.2	37.0	197
11	11.7	10.5		6.9	24.1			7.5	49.0	264
18	12.0	12.2	1.2	5.5	21.8			6.3	47.0	250
14	30.3	6.8		2.8	11.0			3.1	23.7	163
					Weighted Average					
	11.9	9.2	.7	4.0	15.5			4.4	33.8	232

Table 3, man labor and horse work by operation, shows that Farm 13 required fewer man hours per acre to prepare the land, apply fertilizer, harrow and plant, cultivate, pick and haul, but more time to hoe and chop. All man labor was valued at 15c per hour. Farm 13 also used fewer hours of horse work per acre for all operations except hauling to gin although the cost per hour of this work (Table 9) was much higher than that for Farm 1. High yields per acre play an important part in lowering costs per pound. Farm 13 secured the higher yield although its net cost per acre was less. This might be accounted for in several ways: the soil could have been naturally more fertile or more free from weeds; planting and cultivation could have been at a more opportune time; or a higher yielding variety of cotton could have been grown.

TABLE 4 FERTILIZERS--Kinds and Amounts per Acre on Cotton and Corn
Choctaw County—1926

	Cotton—18 Farms					Corn—19 Farms				
Farm No.	A. per Farm	Manure	Acid Phos.	Nitrate of Soda	Mixed	A. per Farm	Manure	Acid Phos.	Nitrate of Soda	Mixed
	No.	Tons	Lbs.	Lbs.		No.	Tons	Lbs.	Lbs.	Lbs.
1	5.1	1.20	157		137	14.1	.04	21		14
2	13.0		192	97		8.8		80	38	
3	11.8	.50	136	51	93	13.0			31	
4	18.2	.30	56	18	181	9.6				
5	26.1		130	45	31	13.8	.50	145		
6	6.5	.80	138	62	107	12.6		8	48	8
7	13.2		45		152	10.7				
8	1.5	5.00			200	7.0		128		
9	14.0		143	16		10.2				
10						14.5		83		
11	11.7		145	77	86	11.1		90		
12	9.9		101	61		10.1		49	40	
13	5.2				230	15.3				39
14	30.3		46		133 1/	5.9		102		136 1/
15	2.5		240	160	80 2/	5.8	.50	233	34	
16	2.1	1.40			179	11.7	.38	43		
17	7.0		186	91		8.6		47		
18	12.0		175	83		10.0		40		
19	23.5	.10	115	19	21	21.5				
	Weighted Average					Weighted Average				
	11.9	.16	111	37	76	11.3	.07	46	9	8

1/ 41 pounds cotton seed meal.
2/ Kainit.

Table 4 shows the kinds and amounts of fertilizer used on cotton and corn.

The judicious use of fertilizers involves three important considerations: (1) the determination of the particular needs of a given soil for growing the chosen crop, (2) the cheapest source of the fertilizer needed, and (3) the best time and method of application. Since most expenditures for fertilizer in the community go to cotton, this crop may be used to illustrate the three points.

Experiments run in the community 1* have shown that approximately

1* Miss. Station Bulletin No. 241—Cotton: Fertilizers and Varieties, 1926. By J. F. O'Kelly, C. B. Anders, and W. W. Hull.

600 pounds per acre of an 8-6-4 mixture gives the most profitable returns. This fertilizer was prepared by home mixing 300 pounds of Acid Phosphate, 225 pounds of Nitrate of Soda, and 50 pounds of Muriate of Potash.

After deciding upon the formula to be used, the cheapest source of the fertilizing elements should be considered. This involves a few calculations which may be illustrated by using Farms 13 and 5, Table 4.

Farm 13 used 230 pounds per acre of a 10-3-3 mixed fertilizer, costing $1.60 per hundred. The cost per acre, therefore, was $3.68 (2.3x$1.60). The usable elements in 230 pounds of the mixture, as calculated, are; Phosphorus 23 pounds (2.3x10); Nitrogen, 6.9 pounds (2.3x3); and Potash, 6.9 pounds (2.3x3).

Farm 5 used 206 pounds per acre of a home mixture consisting of 130 pounds 18 % Acid Phosphate @ 92c per cwt—$1.20; 45 pounds of Nitrate of Soda @ $2.93 per cwt.—$1.32; and 31 pounds of 10-3-3 @ $1.60 per cwt.—$ .50 making a total cost per acre of $3.02.

The usable elements in the latter mixture amount to; Phosphorus, 26.5 pounds (1.3x18) plus .31x10); Nitrogen, 7.68 pounds (.45x15) plus .31x3); and Potash, .93 pounds (.31x3). It is thus shown that Farm 5 had 24 pounds less material to haul and distribute; had 3.5 pounds more Phosphorus, and .78 pounds more Nitrogen, but 5.97 pounds less Potash. The material cost 66 cents less per acre, and necessitated the additional work of mixing. There is still the problem of whether the home mixed fertilizer was as good as the factory mixed, since it was low in Potash. The addition of one pound of Nitrate of Soda, and the substitution of 58 pounds of 12 % Kainit for the 31 pounds of 10-3-3 would give the following figures: Total per acre, 234 pounds (130 plus 46 plus 58); Phosphorus 23.4 pounds (1.3x18); Nitrogen 6.9 pounds (.46x15); and Potash 6.96 pounds (.58x12). The cost per acre with Kainit @ 85c per cwt. would be $3.04. This combination makes 4 pounds more to haul and distribute; it is the equal or better than that used on Farm 13 in each element, and the acre cost is 64 cents less, which may be taken as pay for the labor of mixing.

In the Station experiments referred to above, all fertilizer was applied at time of planting. This has given satisfactory results. Good results have been had in similar communities by side dressing with a readily available nitrogen fertilizer during the growing season. Such a practice might prove helpful during times when nitrates are unavailable at planting time or under other abnormal conditions.

TABLE 5. CORN—Cost per Acre and per Bushel
Arrayed on Cost of Producing Grain
19 Farms—Choctaw County—1926

Farm No.	A. per Farm	Man Labor	Horse Work	Fert-ilizers	Other Costs 1/	Gross Cost 2/	Fod. & Pasture Credit	Net Cost	Yield per A.	Cost per Bu.
	No.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Bus.	Dols.
3	13.0	2.79	2.83	.92	.46	7.00	.31	6.69	19.2	.35
1	14.1	4.76	2.20	.51	.49	7.96	.34	7.62	21.0	.36
2	8.8	3.45	2.62	1.88	.50	8.45	.28	8.17	17.5	.47
12	10.1	4.74	2.99	1.64	.61	9.98	.66	9.32	19.3	.48
8	7.0	8.52	8.36	1.35	1.36	19.59	.86	18.73	38.6	.49
19	21.5	6.26	4.76	-	.84	11.86	.17	11.69	23.3	.50
6	12.6	3.50	2.19	1.59	.49	7.77	.19	7.58	14.3	.53
17	8.6	4.62	2.86	.47	.66	8.61	.28	8.33	15.3	.54
13	15.3	3.92	6.23	.63	.83	11.61	.32	11.29	19.6	.58
11	11.1	6.04	3.90	.87	.80	11.61	.16	11.45	18.6	.61
10	14.5	8.19	4.10	.80	.99	14.08	1.18	12.90	19.0	.68
7	10.7	8.08	5.71		.99	14.78	.15	14.63	21.0	.70
14	5.9	9.09	5.27	3.19	.88	18.43	.62	17.81	25.4	.70
5	13.8	8.62	3.01	2.30	.77	14.70	.92	13.78	18.2	.76
4	9.6	5.92	5.47	-	.83	12.22	-	12.22	15.6	.78
16	11.7	5.67	3.09	1.15	.90	10.81	.42	10.39	12.3	.85
18	10.0	12.52	8.54	.39	1.27	22.72	.12	22.60	25.6	.88
15	5.8	8.64	17.04	4.29	1.43	31.40	.84	30.56	33.6	.91
9	10.2	4.50	3.94	- - -	.58	9.02	.98	8.04	7.8	1.03
					Weighted Average					
	11.3	6.11	4.57	.98	.80	12.46	.44	12.02	19.7	.61

1/ Machinery use charge at two cents per hour, and seed.
2/ Exclusive of land use charge.

TABLE 6. CORN—Man Labor and Horse Work by Operations
Arrayed on Cost of Producing Corn
Man Labor per Acre

Farm No.	A. per Farm	Prepar-ation	A'ply. Fert.	Har'w & Plant	Culti-vate	Hoe	Pull & Haul 1/	Total Labor	Yield per A.
	No.	Hours	Hours	Hours	Hours	Hours	Hours	Hours	Bus.
3	13.0	4.2	-	2.3	6.8	2.3	3.0	18.6	19.2
1	14.1	2.8	.4	3.9	7.4	9.3	7.9	31.7	21.0
2	8.8	4.7	1.1	2.7	5.7	3.7	5.1	23.0	17.5
12	10.1	8.0	-	3.1	10.8	7.1	2.6	31.6	19.3
8	7.0	19.4	4.3	5.8	8.0	6.8	12.5	56.8	38.6
19	21.5	11.3	-	5.3	10.5	5.6	9.0	41.7	23.3
6	12.6	5.0	.6	2.3	7.8	5.0	2.6	23.3	14.3
17	8.6	4.7	1.2	4.2	8.5	3.9	8.3	30.8	15.3
13	15.3	6.4	.3	2.9	7.9	3.6	5.0	26.1	19.6
11	11.1	11.2	1.8	4.9	11.9	5.4	5.1	40.3	18.6
10	14.5	15.1	1.4	6.6	12.5	9.7	9.3	54.6	19.0
7	10.7	14.8	-	5.4	15.8	10.1	7.8	53.9	21.0
14	5.9	12.5	2.9	4.4	14.4	19.3	7.1	60.6	25.4
5	13.8	10.9	2.8	3.9	11.0	21.0	7.9	57.5	18.2
4	9.6	8.2	- - -	3.7	11.6	10.8	5.2	39.5	15.6
16	11.7	14.7	.3	.9	10.9	5.8	5.2	37.8	12.3
18	10.0	16.1	4.9	9.8	16.2	28.5	8.0	83.5	25.6
15	5.8	12.2	5.6	6.5	19.8	4.5	9.0	57.6	33.6
9	10.2	7.0	- - -	2.4	9.6	5.4	5.6	30.0	7.8
					Weighted Average				
	11.3	9.7	1.1	4.2	10.5	8.6	6.6	40.7	19.7

TABLE 6—(Continued) Horse Work per Acre

Farm No.	A. per Farm	Preparation	A'ply-Fert.	Har'w & Plant	Cultivate	Hoe	Pull & Haul	Total Labor	Yield per A.
3	13.0	4.2		2.3	6.8		2.8	16.1	19.2
1	14.1	5.2		4.4	7.4		3.0	20.0	21.0
2	8.8	4.7		3.2	5.7		4.5	18.1	17.5
12	10.1	8.5		3.1	10.8		2.3	24.7	19.3
8	7.0	34.8	4.3	5.8	8.0		6.8	59.7	38.6
19	21.5	12.4		5.8	10.5		4.1	32.8	23.3
6	12.6	5.0		2.3	7.8		1.6	16.7	14.3
17	8.6	7.9		4.8	8.5		5.8	27.0	15.3
13	15.3	12.2		3.8	9.2		10.0	35.2	19.6
11	11.1	12.1		7.0	11.9		2.9	33.9	18.6
10	14.5	17.0		5.8	12.5		7.4	42.7	19.0
7	10.7	14.8		5.4	15.8		3.9	39.9	21.0
14	5.9	12.5		4.8	14.4		3.0	34.7	25.4
5	13.8	11.6		3.9	11.4		4.8	31.7	18.2
4	9.6	10.9		3.2	11.6		5.2	30.9	15.6
16	11.7	20.6	.6	.9	10.9		5.2	38.2	12.3
18	10.0	19.0		10.2	16.2		8.0	53.4	25.6
15	5.8	24.1	2.6	8.1	22.1		6.2	63.1	33.6
9	10.2	7.5		2.4	9.6		1.8	21.3	7.8
				Weighted Average					
	11.3	12.2	.3	4.5	10.7		4.7	32.4	19.7

1/ Includes pulling fodder.

Tables 5 and 6 show the itemized cost per acre with the cost per bushel, and the distribution of man labor and horse work per acre, for corn.

As with cotton, the cost per unit depends on the net cost per acre and the yield per acre.

Farms 3 and 10, growing similar acreage and having similar acre yields, may be used to illustrate the differences in cost. Farm 10 used almost three times as much man labor per acre on corn as did Farm 3. It used over two and one half times as much horse work per acre, but this work cost only a little over half as much per hour (Table 9). Farm 3 spent more per acre for fertilizers, but less than half as much for "other costs". The fodder and pasture credit was larger for Farm 10. In all, the net costs per acre were $6.69 and $12.90 for Farms 3 and 10 respectively. These costs divided by the yields of 19.2 and 19 bushels gives the costs per bushel of 35 and 68 cents.

TABLE 7. OATS—Cost per Acre and per Bushel
Arrayed on Cost of Producing Grain
5 Farms—Choctaw County—1926

Farm No.	A. per Farm	Man Labor	Horse Work	Threshing	Other Costs 1/	Total Cost 2/	Estim'd Yield 3/	Cost per Bu.
	No.	Dollars	Dollars	Dollars	Dollars	Dollars	Bushels	Dollars
19	12.4	2.14	.77	.20	.91	4.02	14.1	.29
18	6.0	2.04	1.60	-- --	2.32	5.96	18.5	.32
8	5.6	1.06	1.99		2.38	5.43	15.0	.36
16	2.0	2.32	.93	-- --	2.73	5.98	15.0	.40
15	3.0	2.10	9.32	-- --	7.33	18.75	16.6	1.12
				Weighted Average				
	5.8	1.92	2.04	.09	2.29	6.34	15.5	.41

1/ Machinery use charge at two cents per hour, and seed.

2/ Exclusive of land use charge.

3 The usual practice is to feed oats in bundle.

TABLE 8. OATS—Man Labor and Horse Work by Operations
Arrayed on Cost per Bushel

Farm No.	A. per Farm	Land Prep.	Harrow and Sow 1/	Harvest 2/	Total Labor	Estimated Yield
	Number	Hours	Hours	Hours	Hours	Bushels
			Man Labor per Acre			
19	12.4	3.9	.5	9.9 3/	14.3	14.1
18	6.0	4/	3.3	10.3	13.6	18.5
8	5.6	4/	4.3	2.8	7.1	15.0
16	2.0	4/	5.5	10.0	15.5	15.0
15	3.0	4/	10.0	4.0	14.0	16.6
			Weighted Average			
	5.8	1.7	3.1	8.0	12.8	15.5
			Horse Work per Acre			
19	12.4	3.9		1.4 3/	5.3	14.1
18	6.0	4/	6.7	3.3	10.0	18.5
8	5.6	4/	8.6	5.6	14.2	15.0
16	2.0	4/	9.5	2.0	11.5	15.0
15	3.0	4/	22.0	11.3	33.3	16.6
			Weighted Average			
	5.8	1.7	5.9	3.7	11.3	15.5

1/ The common practice is to broadcast the seed and plow under.

2/ Usually mowed or cradled and bound by hand.

3/ Includes 1.4 hours for threshing a portion of crop.

4/ Included in Harrow and Sow.

Tables 7 and 8 show the cost per acre and per bushel on five crops of oats together with the man labor and horse work distribution by operations.

A small acreage of oats should pay well on most farms of the area. Labor requirements usually come at a time when the major crops are not greatly in need of attention. The cost per bushel was quite low even with the low average yield of 15.5 bushels. A better yield might be expected were more attention given to sowing and some fertilizer used. The usual practice of broadcasting the oats and turning in with a breaking

plow risks covering the oats so deep that a poor stand will result, while oats sown without fertilizer are limited to the natural fertility of the soil for plant food. This is usually low and hence oat yields are low under such conditions.

Five crops of lespedeza hay were cut, averaging 4.3 acres per crop. All were volunteer seedings. Because of no land preparation or sowing, and a fair yield of hay, the average cost per ton was very low. The average yield for the 21.5 acres cut was 1.38 tons per acre and the average cost per ton was $3.82.

Records were kept on three crops of cane and one crop of sorghum separate from truck crops. On most farms these crops, due to the small acreage, were grouped with truck.

The four crops comprising 2 acres in all, of which .3 of an acre was sorghum, had an average gross cost per acre of $44.30; a seed credit of $18.50, and a net cost of $25.80. The average yield of syrup per acre was 121 gallons and the average cost per gallon, 21 cents.

Syrup has been a profitable crop for the past few years and should remain so up to the point of supplying the local demand and markets in nearby towns.

TABLE 9. WORKSTOCK—Annual Cost of Maintenance per Animal Unit and Cost per Hour of Horse Work
Arrayed on Cost per Hour of Work
19 Farms—Choctaw County—1926

Farm No.	Animal Units per F'm	Value of Feed	Val. of Pasture	Depreciation	Other Costs 1/	Total Costs 2/	Appreciation	Net Cost	Hours Worked per Unit	Cost per Hour
	No.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	No.	Cents
16	2.90	51.04	2.52		12.75	66.31	5.17	61.14	754	8.1
5	3.00	62.00	.80		16.61	79.41	11.67	67.74	716	9.5
10	8.00	56.16	1.52	2.50	15.66	75.84		75.84	793	9.6
17	2.00	49.58	1.50		20.68	71.76	26.40	45.36	466	10.6
1	3.00	53.68	1.22		16.40	71.30	5.00	66.30	602	11.0
11	2.00	72.59	1.54	27.50	16.65	118.28		118.28	868	11.5
12	3.00	53.17	1.80	6.67	16.47	78.11		78.11	646	12.1
6	2.00	54.37	1.84		21.29	77.50	20.00	57.50	438	13.1
8	4.00	71.93	1.80		20.89	94.62	5.00	89.62	638	14.0
7	2.62	55.72	1.86	17.18	19.53	94.29		94.29	660	14.3
2	2.34	42.89	1.80		17.41	62.10	1.07	61.03	422	14.5
19	3.00	81.90	1.22	21.67	28.63	133.42		133.42	913	14.6
14	2.87	62.83	1.70		16.97	81.50	22.65	58.85	388	15.2
18	2.00	94.80	.60	10.00	22.87	128.27		128.27	799	16.0
3	2.00	54.12	2.40	2.50	19.34	78.36		78.36	445	17.6
4	3.00	44.66	.60	8.34	23.80	77.40		77.40	438	17.7
13	2.11	71.92	2.28		14.00	88.20	11.84	76.36	430	17.7
9	1.00	75.25	3.00		15.37	93.62	5.00	88.62	478	18.5
15	2.00	65.70	3.02	10.00	17.69	96.41		96.41	356	27.0
					Weighted Average					
	2.78	60.69	1.66	5.20	18.42	85.97	5.06	80.91	624	13.0

1/ Man Labor Charge, Interest and Taxes.

2/ Balancing Building Charge with Manure Credit.

TABLE 10. WORKSTOCK—Annual Quantity Costs per Animal Unit Arrayed on Cost per Hour of Horse Work
19 Farms—Choctaw County—1926

Farm No	Animal Units per F'm	Grains				Roughage			Past'e	Man Labor
		Corn 1/	Oats	Mill Feed	Total	Hay	Fodder 2/	Total		
	No.	Lbs.	Lbs.	Lbs.	Lbs.	Tons	Tons	Tons	Days	Hours
16	2.90	3277	331		3608	.59		.59	126	52.0
5	3.00	3792			3792	.33	.33	.66	40	48.0
10	8.00	3662			3662	.50		.50	76	28.6
17	2.00	3240	192	50	3482	.12		.12	75	65.1
1	3.00	3552			3552	.63	.05	.68	61	47.3
11	2.00	3744		550	4294	.72	.05	.77	77	50.0
12	3.00	2388		67	2455	1.33		1.33	90	45.6
6	2.00	3600			3600	.38		.38	92	65.2
8	4.00	4104	408		4512	.78		.78	90	60.0
7	2.62	3902			3902	.19		.19	93	59.8
2	2.34	2308	205		2513	.53		.53	90	57.0
19	3.00	5832	384		6216	.17		.17	61	98.5
14	2.87	4164		418	4582	.07		.07	85	69.0
18	2.00	3348	1616		4964	1.00		1.00	30	107.8
3	2.00	4428			4428				120	66.1
4	3.00	2952			2952	.33		.33	30	62.6
13	2.11	3190		95	3285	1.20	.40	1.60	114	41.5
9	1.00	3528	640		4168	.50	.54	1.04	150	62.5
15	2.00	3564	528		4092	.60		.60	151	53.3
					Weighted Average					
	2.78	3642	180	53	3875	.53	.04	.57	83	56.5

1 In ear unhusked—72 pounds to 1 bushel.
2/ Blades stripped from stalk.

Table 9 shows the money values of the items making up the cost of horse work while Table 10 shows the quantities of feed, pasture and man labor expended per animal unit on the farms studied.

Since horse work is an item which enters into the cost of practically all farm crops, the economical handling of the workstock reflects itself in lower costs for salable products.

Cost of feed and the amount of work accomplished are the principal factors in making the cost per hour of work. A comparison of these factors on Farm 11 and 18 will show the desirability of studying the horse account.

Farm 11, with two work animals, had the following costs per head: feed and pasture $74.13, depreciation $27.50, and "other costs" $16.65, making a total of $118.28. The work accomplished was 868 hours and the cost per hour 11.5 cents.

Farm 18, also with two work animals, shows corresponding figures of $95.40, $10.00, and $22.87, making a total of $128.27. The work accomplished per head was only 799 hours and the cost was 16 cents per hour.

Table 10 shows that Farm 11 fed 4294 pounds of grain and .77 of a ton of hay per head while corresponding figures for Farm 18 were 4964 pounds and 1 ton.

The problem here is to reduce the feed to the minimum requirements consistent with the work expected. Horses must be fed something even when idle. Experiments have shown that the grain ration may be reduced by half when the animal is not working with no loss in efficiency when work is again begun. High quality hay alone, a part of which at least is legume, will maintain work animals during long idle periods. At such times grain feeding should be commenced a few weeks before work is to begin. Where animals are kept constantly on full grain feed, they should be constantly worked. Farm 11, which was surpassed by only one farm in the time worked per animal, worked each animal only 87 days of 10 hours each. Allowing 300 working days per year, these animals were idle 213 days. Were they fed grain all the time? If so; how much per day? Did they really need it all, or would half as much, or possibly none for part of the time, have kept them in fair condition? Could they have worked more by a different selection and arrangement of crops or by some outside work at slack farming seasons? A correct answer to these questions and action on the conclusions reached will materially lower the cost per hour of horse work.

TABLE 11. DAIRY COWS—Annual Cost of Maintenance per Animal Unit and Cost per Pound of Butter Fat
Arrayed on Cost per Pound of Butter Fat
19 Farms—Choctaw County—1926

Farm No.	Animal Units per F'm	Value of Feed	Value of Past'e	Depre-ciation 1/	Man Labor	Other Costs 2/	Total Costs 3/	Butter Fat per Unit	C't per lb. But-ter Fat
	No.	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Pounds	Cents
9	1.04	11.06	2.94	4.62	9.78	2.31	30.71	278.7	11.0
15	2.00	22.90	2.14	2.70	12.05	1.50	41.29	290.8	14.2
12	2.00	2.77	3.06	3.30	11.31	1.80	22.24	109.6	20.3
3	2.00	8.65	3.06	3.90	11.36	2.48	29.45	126.2	23.3
5	1.81	15.63	5.08	5.97	16.39	4.33	47.40	202.2	23.4
13	3.00	15.33	3.06	3.60	6.80	2.05	30.84	129.8	23.8
10	11.42	28.39	1.56	3.94	7.42	3.61	44.92	180.2	24.9
18	1.00	45.10	3.06	3.00	21.48	2.55	75.19	281.0	26.8
1	4.61	14.23	2.66	2.22	8.52	1.81	29.44	96.0	30.7
14	3.49	11.92	2.64	4.22	8.76	2.55	30.09	98.0	30.7
2	1.00	19.77	3.06	4.20	19.42	2.55	49.00	157.0	31.2
7	2.37	21.24	2.58	4.05	10.28	3.04	41.19	125.0	33.0
17	1.25	9.96	3.42	4.32	14.74	2.76	35.20	100.0	35.2
8	3.00	43.13	3.06	3.80	17.11	2.10	69.20	190.9	36.2
16	2.00	20.59	3.06	2.82	12.34	1.69	40.50	106.4	38.1
4	2.00	18.55	1.84	4.80	12.76	2.70	40.65	94.6	43.0
6	1.51	13.82	2.84	3.77	13.70	1.89	36.02	81.6	44.1
19	2.83	16.32	3.26	3.82	16.66	2.00	42.06	92.4	45.5
11	1.75	23.51	2.80	4.53	14.19	1.81	46.84	100.0	46.8
					Weighted Average				
	2.64	20.56	2.62	3.78	11.22	2.58	40.76	146.5	27.8

1/ Calculated at 12 per cent.

2/ Horse work at cost, interest at 6 per cent and taxes where not exempt.

3/ Balancing building and equipment charges against manure and skim milk credits.

TABLE 12. DAIRY COWS—Annual Quantity Costs per Animal Unit Arrayed on Cost of Producing Butter Fat
19 Farms—Choctaw County—1926

Farm No.	Concentrates					Roughage			Past'e	Man Labor	Horse Work
	Cotton Seed Meal	Cotton Seed	Corn 1/	Other 2/	Total	Hay	Cotton Seed Hulls	Total			
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Tons	Tons	Tons	Days	Hours	Hours
9	385				385		.82	.82	147	65.2	
15	600			420	1020		.45	.45	107	80.4	
12	125				125		.08	.08	153	75.4	
3	250				250	.12	.30	.42	153	75.7	3.0
5	580				580		.76	.76	254	109.2	13.2
13		160	240		400	.70		.70	153	45.4	
10	849		567		1416	.11	.28	.39	78	49.5	6.0
18	575		1800	256	2631		.50	.50	153	143.2	
1	445				445	.22	.29	.51	133	56.8	3.5
14	344	76			420		.71	.71	132	58.4	2.9
2	550		360		910		.65	.65	153	129.5	
7	169	1013	273		1455		.30	.30	129	68.5	7.6
17	240	264			504		.36	.36	171	98.3	
8	533	480	480		1493	.80	.58	1.38	153	114.1	
16	225			470	695	.40	.38	.78	153	82.3	
4	325	445			770	.25	.25	.50	92	85.1	
6	464				464		.56	.56	142	91.3	
19	212		382	79	673	.35		.35	163	111.1	
11	286		534		820	.70	.20	.90	140	94.6	
	Weighted Average										
	453	118	268	45	884	.20	.35	.55	131	74.8	2.9

1/ In ear, unhusked—72 pounds to 1 bushel.
2/ Sweet Potatoes, Oats and Sweet Feed in order named.

Dairy cows were kept in the community primarily for family use although milk may be successfullly shipped to the condensing plant at Starkville, during the winter months, and probably, with proper cooling facilities, during the summer months, also.

A comparison of a few farms of the community shows the desirability of keeping high producing cows. Good cows with plenty of good feed form the ideal low cost combination. Only good cows will make full use of feed consumed.

Farms 15 and 16 produced butterfat at costs of 14.2 and 38.1 cents per pound respectively. There was little difference in the total feed costs, but it will be noted (Table 12) that Farm 15 fed more concentrate and less roughage per head than Farm 16. Farm 15 obtained over twice as much butterfat per head as Farm 16. This difference may be accounted for in part by the difference in feeding and in part by a difference in productive ability of cows.

Farm 17 had a very low feed cost and a low production. Cows on this farm might have produced more had they been fed heavier.

Farm 11, with a feed cost per head greater than that on Farm 15, secured considerably less than half the production. Corn, in large quantities, does not make a good dairy feed.

Good pastures form one of the most economical sources of dairy feed. Doubtless, much of the difference in production on the several farms was due to difference in the quality of pastures. Much may be done in the way of pasture improvement by introducing desirable pasture plants and mowing off undesirable weeds.

The usual practice of the community is to raise all calves by allowing the calf to suck during some stage of the milking operation. A more economical method would be to kill or dispose of the bull calves at birth and raise the heifers by hand feeding on skim milk.

TABLE 13.

POULTRY—Annual Cost per Head, Cost per Dozen Eggs 1/ and Net Profit per Head 2/. Arrayed on Net Profit per Head

19 Farms—Choctaw County, 1926

Farm No.	Poultry per Farm	Value of Feed	Value of Lab.	Cost per H'd 3/	Eggs per H'd	Cost per Dz. Eggs	Meat per H'd	Value of Meat	Profit per H'd
	No.	Dollars	Dollars	Dollars	Dozens	Cents	Lbs.	Dollars	Dollars
10	50	.86	.16 4/	1.02	3.58	28.8	9.5	2.82	2.70
11	21	.53	.45	.98	7.25	13.5	7.0	1.40	2.23
13	72	.54	.11	.65	5.82	11.2	6.5	1.30	2.11
4	27	.35	.27	.62	5.00	12.4	3.9	.77	2.02
16	39	.41	.17	.58	6.00	9.7	5.4	1.09	2.01
9	22	.39	.21	.60	5.42	11.1	5.8	1.24	1.99
15	52	.42	.15	.57	5.75	9.9	4.6	1.00	1.87
1	56	.35	.12	.47	3.58	13.1	5.9	1.32	1.75
5	35	.50	.18	.68	4.83	13.9	6.2	1.20	1.73
18	39	.45	.24	.69	5.00	13.8	4.1	.82	1.38
14	34	.24	.18	.42	4.33	9.7	3.2	.64	1.30
2	40	.25	.24	.49	3.75	13.1	4.2	.84	1.29
8	70	.23	.14	.37	4.00	9.2	2.6	.51	1.14
6	45	.28	.19	.47	4.25	11.1	2.0	.40	.99
17	39	.11	.23	.34	3.50	9.9	2.0	.40	.94
7	33	.64	.25	.89	3.33	26.7	4.9	.98	.92
12	81	.10	.07	.17	3.00	5.9	1.3	.27	.85
19	35	1.31	.26	1.57	6.42	24.5	3.0	.70	.73
3	42	.26	.28 5/	.54	4.00	13.7	.8	.16	.62
				Weighted Average					
	44	.41	.19	.60	4.50	13.3	4.2	.92	1.45

1/ Annual cost per head divided by eggs produced.
By crediting the value of meat, most farms would produce eggs at a minus cost.

2/ Eggs valued at 25 cents per dozen.

3/ Building charge balance against manure credit.

4/ Contains some horse work.

5/ Contains a hatchery charge.

TABLE 14. POULTRY—Annual Quantity Expenditures per Head Arrayed on Net Profit per Head 19 Farms—Choctaw County—1926

Farm No.	Head per F'm	Corn & Sorghum	Mill Feeds	Total Grain	Skim Milk	Man Labor
	Number	Pounds	Pounds	Pounds	Gallons	Hours
10	50	29.0		29.0	14.6	1.0
11	21	44.5		44.5		3.0
13	72	22.0	3.0	25.0	5.1	.8
4	27	26.6		26.6		1.8
16	39	18.0	5.0	23.0	.9	1.1
9	22	20.0		20.0	4.1	1.4
15	52	8.3	1.9	10.2	7.9	1.0
1	56	23.1		23.1	2.1	.8
5	35	33.0		33.0	2.2	1.2
18	39	30.0	1.6	31.6	.8	1.6
14	34	19.0		19.0		1.2
2	40	14.4	2.3	16.7		1.6
8	70	15.4		15.4	.9	.9
6	45	4.8	6.8	11.6	1.0	1.3
17	39	7.4		7.4	.6	1.6
7	33	42.0		42.0		1.7
12	81	5.3		5.3	1.0	.5
19	35	43.0		43.0	21.4	1.8
3	42	20.6		20.6		1.1
			Weighted Average			
	44	20.1	1.3	21.4	3.4	1.2

Poultry, besides supplying the family with eggs and table fowls, also adds something to the farm incomes of the community.

Tables 13 and 14 show the poultry costs for the farms studied. A few farms raised turkeys which are included with chickens.

The outstanding factors of a profitable poultry enterprise are early hatching, culling out and disposal of non-laying hens, and liberal feeding. Flocks of uniform breeding yield products of superior quality and appearance.

The poultry keeper may either choose to specialize in the production of eggs or meat birds, or he may prefer to keep a general purpose flock for both eggs and table fowls. In any case, the management will be much the same, except where eggs are the principal consideration, one of the light breeds should be selected. High production per bird should be the objective of the poultry keeper.

TABLE 15. PORK PRODUCTION--Quantity Expenditures per Hundredweight of Dressed Pork, with Values 1/
Arrayed on Cost per cwt. of Dressed Pork
19 Farms—Choctaw County—1926

Farm No.	Pork produced per Farm	FEED						Man Labor		Cost per 100
		Corn 2/	Shorts	Total Grain		Skim Milk		Amount	Value	
				Amount	Value	Amount	Value			
	Lbs.	Lbs.	Lbs.	Lbs.	Dols.	Gals.	Dols.	Hrs.	Dols.	Dols.
2	649	355	15	370	4.56			10.9	1.64	6.20
9	575	301		301	3.91	48	1.66	8.0	1.20	6.77
11	1066	486		486	5.53			9.3	1.40	6.93
3	1180	531		531	6.02	9	.32	5.4	.81	7.15
5	960	442		442	5.63	23	.81	6.6	.98	7.42
13	464	559		559	7.22			12.8	1.91	9.13
14	645	514	93	607	7.75			9.9	1.49	9.24
6	580	571	86	657	8.53	24	.82	9.9	1.49	10.84
12	327	726		726	8.56	49	1.69	15.4	2.31	12.56
17	308	795		795	9.90			18.9	2.84	12.74
18	502	932	20	952	11.85	10	.35	16.0	2.40	14.60
1	723	1005		1005	11.72	47	1.63	9.4	1.40	14.75
15	575	814	52	866	10.40	96	3.35	9.7	1.46	15.21
19	998	1046		1046	12.22	75	2.62	9.5	1.43	16.27
16	348	1076	57	1133	13.29	29	1.02	17.2	2.58	16.89
7	234	1108	43	1151	15.39			27.3	4.10	19.49
8	679	1251	15	1266	16.79	29	1.02	11.8	1.77	19.58
10	1658	647	48	695	8.71	352	12.26	5.5	.83	21.80
4	188	1493		1493	19.81			27.9	4.18	23.99
					Weighted Average					
	666	705	22	727	8.94	69	2.40	10.1	1.52	12.86

1/ A few farms provided pastures which were not taken into account.

2/ In ear, unhusked—72 pounds to 1 bushel.

Hogs were kept in the community primarily for supplying the home needs for pork products. The cost per hundred pounds of dressed pork ranged from $6.20 to $23.99. The average cost of $12.86 seems higher than it should under the existing conditions.

As may be seen, the cost increases almost directly as the amount of grain feed increases. The problem, then, is to reduce the amount of grain feed required to produce 100 pounds of pork.

Two factors stand out as contributing to high pork costs in the area. The first is the practice of confining the animals closely and making corn almost the sole feed and the second is the practice of carrying fat hogs through the summer. Hogs seldom make economical use of feed after reaching 200 or 250 pounds in weight. The costs per pound gain have been found to increase as the hog approaches a maximum degree of fatness. When hogs reach the killing stage, therefore, they had best be killed and the meat cured. If weather will not permit this, and killing is likely to be delayed for several months, a saving might be made by selling the fat hogs and buying other thrifty pigs to feed. Much may be saved on feeding by providing pasture for growing pigs. Where this is impossible, suitable crops may be planted, and fed green by cutting the

required amount daily. Rape, sorghum, peas, soy beans, sweet clover, or corn make suitable crops for this purpose. Any weeds which hogs will eat may be used in the same way. Eight months should be sufficient time in which to produce 200 pounds of dressed pork from a thrifty pig.

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Mule Feeding Experiments

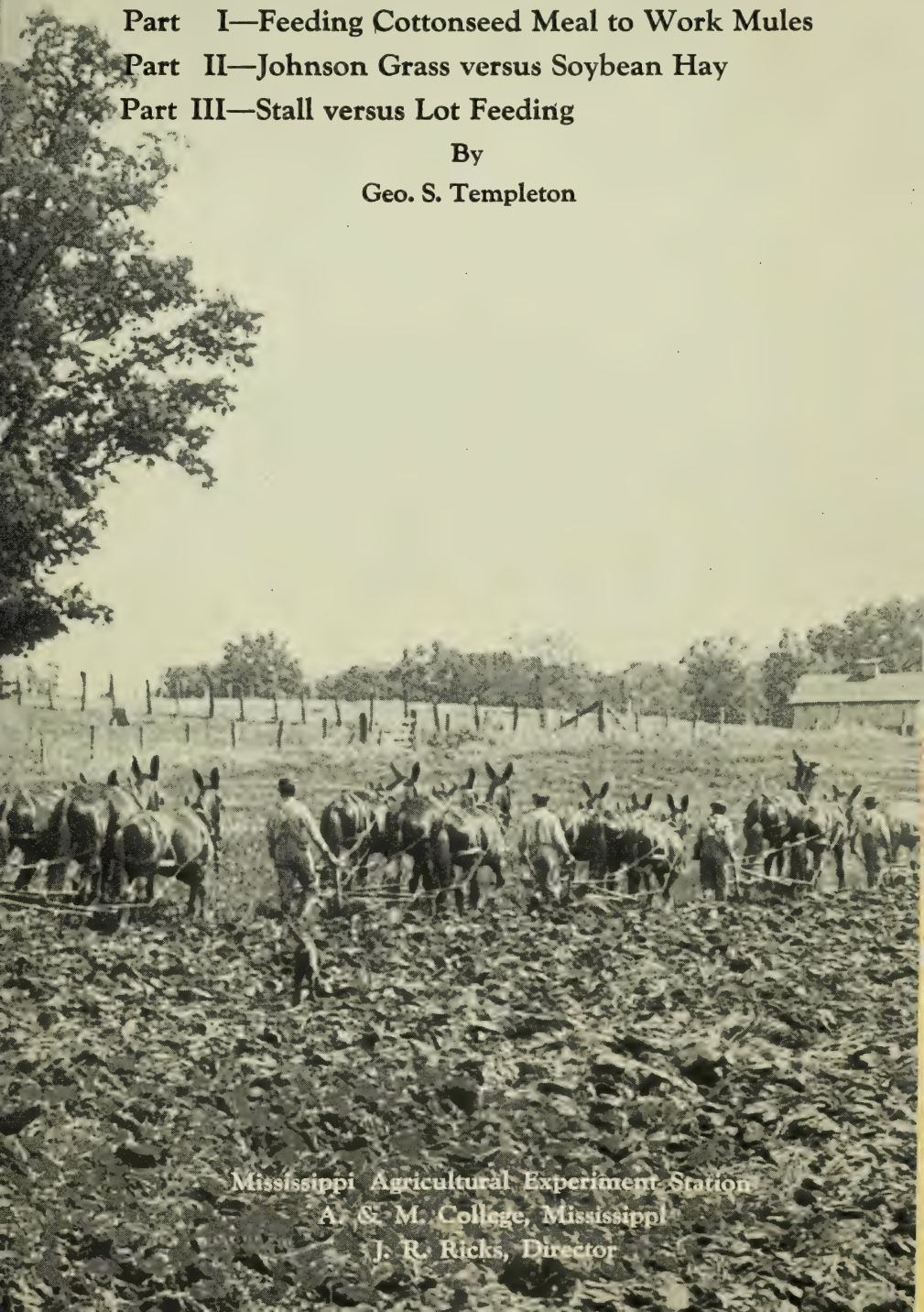
Part I—Feeding Cottonseed Meal to Work Mules

Part II—Johnson Grass versus Soybean Hay

Part III—Stall versus Lot Feeding

By

Geo. S. Templeton



Mississippi Agricultural Experiment Station

A. & M. College, Mississippi

J. R. Ricks, Director

SUMMARY

Ten mules fed a ration composed of 10.28 pounds of ear corn, one pound of cottonseed meal, three pounds of oats, and 15 pounds of Johnson grass hay per thousand pounds live weight per day, consumed their feed with apparent relish.

Ten mules fed the ration of 11.4 pounds of ear corn, 1.1 pounds of cottonseed meal, and 10 pounds of Johnson grass hay per thousand pounds live weight per day, showed a marked difference in desire to consume the meal. Four of the mules took to the ration readily and would have consumed more meal. Six of the ten refused to consume more than 1.1 pounds of meal per thousand pounds live weight daily.

Health, spirit, and endurance of work mules were the same when fed the ration of ear corn as the sole concentrate as when they were fed the ration containing the cottonseed meal or the ration with cottonseed meal and oats.

There was no difference in the condition of the coats of hair of the mules fed the cottonseed meal and of the mules that did not receive the meal. There was apparently more difference in the glossiness of the coat of hair, due to the condition and vitality of the individual mules, than there was between the lots.

Lots II and IV, receiving the ration of ear corn and Johnson grass hay, with a wider nutritive ratio and slightly more total digestible nutrients, maintained the weights of the mules better or put on more gain in live weight than the Lots I and III, receiving the ration containing cottonseed meal, with the narrower nutritive ratio.

The ration for Lot II, consisting of ear corn as the sole concentrate, cost slightly less than the ration for Lot I, containing ear corn, cottonseed meal, and oats. The ration for Lot IV, fed ear corn and Johnson grass hay, cost 2.2 cents per day per mule more than the ration of ear corn, cottonseed meal, and Johnson grass hay fed to Lot III. The ration fed Lot IV contained a larger amount of total digestible nutrients, and this ration was slightly more efficient in maintaining the weight of the mules.

There was no noticeable difference in the spirit or the ability to stand work and heat of the mules consuming the ear corn—Johnson grass hay ration, with a nutritive ratio of 1 : 12.05 that contained 16.29 pounds digestible nutrients, and the mules fed the ear corn-soybean ration with a nutritive ratio of 1 : 6.39 that contained 16.18 pounds of digestible nutrients.

On the basis of this experiment, 12 pounds of Johnson grass hay was the equivalent of 11 pounds of soybean hay. With the prevailing prices of 87 cents per bushel for corn and $12 a ton for Johnson grass hay, the soybean hay was worth $13.09 per ton.

There was no noticeable difference in either the stall or lot-fed mules in their health, spirit, ability to work, or stand heat. The stall-fed mules were fed a ration of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per thousand pounds live weight per day. The lot-fed mules, fed ad libitum, consumed a ration of 16.71 pounds of ear corn and 13.62 pounds of Johnson grass hay per thousand pounds live weight per day.

On the basis of this experiment, it cost $84.37 per year to maintain a mature 1000-pound mule doing heavy work when stall-fed and $113.01 for a 1000-pound mule that was lot-fed.

The rations reported in this bulletin are on the basis of a 1000-pound mule per day. In adapting these rations to mules of other weights, the feed can be figured on the percentage basis. An 800-pound mule would receive 20 per cent less feed, and a 1200-pound mule would receive 20 per cent more feed than indicated for a 1000-pound mule.

PART I

FEEDING COTTONSEED MEAL TO WORK MULES

INTRODUCTION

Cottonseed meal is readily available in the South, requires little space for storage, keeps well, and furnishes protein at a lower cost than most feeds used in rations for work mules. Its value as a cattle feed is well established, but this feed is not generally used for mules. Some feeders report good results from its use, while others state that their mules will not eat it.

Various recommendations regarding the feeding of cottonseed meal appear from time to time in the agricultural press. Some of these articles advise feeding cottonseed meal with ear corn, while others advise using it with ground feeds. The majority of farm and plantation owners in the South do not have access to equipment for grinding feeds. This preparation of feeds involves considerable work and expense. Furthermore, it has as yet to be proved that grinding of most home-grown feeds is economical for mature mules with good teeth.

A large percentage of the work mules in the South are fed a ration composed chiefly of ear corn and grass hay. According to our present feeding standards, this ration is deficient in protein. The availability of cottonseed meal would suggest its use in balancing this type of ration.

Several experiment stations have used cottonseed in rations for mules, and a brief review of the results of these experiments will be of interest.

RESULTS OBTAINED BY THE EXPERIMENT STATIONS IN FEEDING COTTONSEED MEAL

At the Iowa Station*, six pounds of cottonseed meal proved as effective as eight pounds of linseed oil meal in balancing 100 pounds of a grain mixture composed of 15 pounds of ground oats, the remainder being ground corn. The ration containing the cottonseed meal was fully as palatable and efficient in maintaining health and weight of the horses as the oil meal ration.

Two lots of mules were fed at the Mississippi Station** on concentrate rations composed of wheat bran and cottonseed meal. One lot was fed a mixture of three-fourths wheat bran and one-fourth cottonseed meal. Another lot was fed a ration made up of equal parts of bran and cottonseed meal. Both lots ate sparingly of the feed at first and at the end of

*Iowa Bulletin 109.

**Mississippi Annual Report, 1902.

six weeks, they practically refused to eat the mixture. It was thought that since the mules were not accustomed to eating wheat bran perhaps if corn chops were substituted for bran in the mixture, the feed might be more palatable and the mules might be induced to eat more, but such was not the case. At the end of 90 days, the mules were losing flesh so rapidly that the cottonseed meal feeding was discontinued and the mules were put back on corn.

An experiment to determine the relative value of corn and mixed feed for mules was conducted at the Kentucky Station*. The original plan was to use some cottonseed meal with one set of mules, but this idea was abandoned after a 14-day preliminary feed period, when it was observed that the mules would either push the feed containing the meal out of their feed boxes or would leave this grain mixture uneaten. The authors state further "that mules have in several instances been fed as much as two pounds of this meal per day, and probably these mules would have finally eaten it, but the short duration of the experiment made it necessary to substitute the more palatable linseed oil meal for the cottonseed meal."

Farmers' Bulletin Number 1030 advises the mixing of cottonseed meal with blackstrap molasses or some grain feed that is palatable. The meal should be well incorporated with the other feeds. Only bright, fresh, high grade meal should be fed to horses and mules.

No harmful effects developed from feeding cottonseed meal, when it was properly used, at the North Carolina Station** during a three-year test with this feed. The most satisfactory results were obtained by using a fourth of a pound of the meal per head per day at first, and increasing the allowance gradually as the mules became accustomed to the odor and taste of the meal. One pound, or 10 to 15 per cent of the total ration by weight, is considered about the proper amount to feed mules doing medium work. In these tests, it was found impractical to feed mules on cottonseed meal and ear corn. The most palatable ration used was composed of corn-and-cobmeal, wheat bran, and cottonseed meal. The ration of six parts shelled corn and one part cottonseed meal was less expensive, but the mixture was not very palatable.

Bell and Williams, of the United States Department of Agriculture***, advise that one pound of meal per day per thousand pounds live weight is the safest and most satisfactory quantity to feed. Large quantities of meal may result in serious digestive disorders, and even death in some instances.

With the increased prices on all classes of feeds and with the increased attention to the cost of feeding work animals, more questions are being asked about feeding cottonseed meal. To gain more information on the use of this feed, the following experiment was planned:

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*Kentucky Bulletin 176.
**North Carolina Bulletins 215 and 216.
***U. S. D. A. Bulletin 929.

OBJECTS OF THE EXPERIMENT

The objects of the experiment were as follows:

1. To study practical methods of feeding cottonseed meal with ear corn, utilizing home-grown feeds without grinding or other preparation of the feeds.

2. To study the effects of a balanced and unbalanced ration on the condition of farm work mules and their ability to stand work and heat Especial attention was given to the following points:

Health of the mules.
Ability to endure hard work and hot weather.
Maintenance of weight and condition.
Degree of spirit maintained.
Economy of ration.

PLAN OF INVESTIGATION

The plan of the experiment was to divide the 10 pairs of mules into four lots in such a manner as to place team mates in Lots I and II and in Lots III and IV.

The rations for the four lots were as follows:

Lot I—Ear corn, cottonseed meal, oats, and Johnson grass hay.
Lot II—Ear corn and Johnson grass hay.
Lot III—Ear corn, cottonseed meal, and Johnson grass hay.
Lot IV—Ear corn and Johnson grass hay.

The mules were used during the experiment to perform the regular farm work on the Experiment Station farm. The type of farming required the mules to be in condition and available for work throughout the year. Team mates were worked together practically all of the time. Occasionally it was necessary to split teams, but during such periods most of the mules were doing the same kind of work.

The experiment was conducted as above outlined from March 1, 1924. to July 28, 1924, a total of 150 days. At the close of this 150-day feeding period, the mules in Lots I and II were reversed, so that during the second period the mules in Lot II received the rations formerly fed to the mules in Lot I.

The rations for the two lots were changed gradually. The time required to make the change was from July 28, 1924, to August 17, 1924. On this latter date, all of the mules in these two lots were consuming their rations well. The second period was started August 18, 1924, and concluded January 15, 1925.

During August, the farm work was light, and as half of the mules could do the work at this season, the mules in Lots III and IV were turned on pasture. The 10 mules on pasture from July 29 to September 1 made an average gain in live weight of 39.7 pounds.

The first of September the mules in Lots III and IV were brought in from the pasture. The mules were reversed in the lots, so that the team

mates would receive the ration fed to their mate during the first period of the experiment. Fourteen days were required to change the rations. The second period of 150 days started September 16, 1924, and was concluded February 13, 1925. The experiment was thus divided into two periods of 150 days.

The foregoing reversal of the lots was made to eliminate, so far as possible, the factor of individuality among the mules in the lots being compared.

MULES USED

The 20 mules used in this test were raised on the Experiment Station farm. Each pair was matched as evenly as possible in gait, quality, type, and size. The lighter weight mules would class as "cotton mules" and the heavier pairs as "draft mules." The following list gives the age and average weight of mules of each pair at the beginning of the experiment:

Name				Name			
Lot I	Lot II	Age	Weight	Lot III	Lot IV	Age	Weight
George		7	1145	Mandy		8	1005
	Henry	7	1125		Molly	6	968
	Red Rock	4	1112				
Fly		6	1075	Della		10	1116
	Pat	4	1093		White Nell	9	1092
Will		4	1162	Jake		10	1225
	Alice	8	1132		Jane	10	1332
Pigeon		6	1195	Dave		6	978
	Blue	8	1140		Beck	9	988
Nell		9	1232	Joe		8	1003
	Jessie	7	1236		Matt	8	983

The mules in Lots I and II were not carrying as much flesh as was desired when the test was started. The mules in Lots III and IV were in good working condition and were carrying the amount of flesh desired.

FEEDS USED

The Mosby corn used in the test was raised on the Station farm. Sixty-four pounds of ear corn were required to shell out 56 pounds, or one bushel of shelled corn. The ears averaged about two and one-half to the pound. The supply of ear corn was insufficient for the test; so a Number 2 yellow corn was purchased on the Memphis market, and it was fed to Lots I and II from June 18 to October 9, and to Lots III and IV from September 1 to 25. In making the substitution of shelled corn for the ear corn in the rations, one pound of shelled corn replaced 1.14 pounds of ear corn. The rations and tables were figured and are reported in terms of ear corn. The Number 2 oats used in the test were purchased on the market. The cottonseed meal was bright in color and

of good quality. The Johnson grass hay was raised on the farm. The hay varied somewhat in quality, grading from a Number 1 to a Number 2. The mules were fed from the same feeds; consequently, the factor of variation in the feeds was constant in the lots being compared.

PERCENTAGE COMPOSITION OF FEEDS USED

	Water	Ash	Protein	Crude Fiber	Nitrogen Free Extract	Fat
Corn (Mosby)	10.55	1.08	7.31	2.68	74.01	4.37
Corn (Yellow)	10.44	1.13	9.50	3.09	72.21	3.63
Oats	8.40	3.50	12.56	12.60	59.54	3.40
Cottonseed meal	7.40	7.30	39.56	5.77	31.63	8.34
Johnson grass hay	6.77	6.90	5.13	33.58	45.95	1.67

The foregoing analyses were made by the Chemistry Department of the Experiment Station.

FEEDING AND MANAGEMENT

The mules were all fed in individual box stalls. The grain was fed three times a day, hay at night, and water after the morning feed and before the night feed. When working, the mules were always given water when they were taken from the barn and when they returned from work. The corn was fed in three equal feeds. The oats and cottonseed meal were given in equal feeds night and morning. Salt was available at all times.

On Sundays and on idle days, the noon feed was omitted. When not at work, the mules in Lots I and II were turned on pasture, and the mules in Lots III and IV were turned in dry lot. During the warm season, the mules were turned out at night after they had finished eating.

RECORDS

Accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights here presented consist of an average of three weights taken on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered.

Records were kept of the number of days each mule worked and of the health of the animals, and of any unusual circumstances which occurred during the experiment. The records of the temperatures were furnished by Dr. C. F. Briscoe, of the Station staff.

RESULTS OF INVESTIGATION

Ration Fed, Weight Records, and Days Worked. As this experiment was conducted primarily to study methods of feeding cottonseed meal to mules, no attempt was made to use the same amount of total digestible nutrients in comparable lots.

The original plan of the experiment called for a ration of 11.4 pounds of ear corn, 1.5 pounds of cottonseed meal, and 10 pounds of Johnson grass hay for Lot III. This ration, with a nutritive ratio of 1 : 8.2, would have furnished 19.78 pounds of dry matter, 1.78 pounds of crude protein, and 14.36 pounds of total digestible nutrients per thousand pounds live weight per day. The mules refused to consume the 1.5 pounds of meal regularly, so the feed was reduced to the amount they did consume, or 1.1 pounds per thousand pounds live weight.

The pound and the 1.1 pounds of cottonseed meal fed to Lots I and III respectively were sufficient to reduce materially the nutritive ratio in these two rations. It was thought that the rations with a narrower nutritive ratio fed to Lots I and III would prove more efficient than the rations with a wider nutritive ratio fed to Lots II and IV.

The requirements in Morrison's Feeding Standards* for horses and mules doing various kinds of work are as follows:

	Per 1000 pounds live weight			
Horses and Mules	Dry Matter	Crude Protein	Total Digestible Nutrients	Nutritive Ratio
Idle	13.0-18.0	0.8-1.0	7.0- 9.0	8.0-9.0
At light work	15.0-20.0	1.0-1.2	9.0-11.0	8.0-8.5
At medium work	16.0-21.0	1.2-1.5	11.0-13.0	7.8-8.3
At heavy work	18.0-22.0	1.5-1.8	13.0-15.0	7.6-8.1

By comparing the analyses of the rations fed in this experiment, as given in Table 2, with the Morrison standards, it will be seen that Lots I and II were fed much heavier than recommended in the standard. These two lots of mules were not carrying the flesh desired, so they were fed a heavy ration to improve their condition. The rations fed Lots III and IV meet the requirements of the standard for mules at heavy work, except the nutritive ratio for Lot III is a little wide and the ratio for Lot IV is much too wide.

Table 1 summarizes the results of the experiments for the rations fed, weights of the mules, and record of the days worked.

*Feeds and Feeding, 18th edition, page 748.

Table 1—RATIONS FED, WEIGHT RECORDS, AND DAYS WORKED

Ration	Lot I 10.26 lbs. Ear corn 1.00 lb. C. S. M. 3.00 lbs. Oats	Lot II 16 lbs. Ear corn	Lot III 11.4 lbs. Ear corn 1.1 lbs. C. S. M.	Lot IV 13.7 lbs. Ear corn
er 1000 lbs live weight per day	15 lbs. Johnson grass hay	15 lbs. Johnson grass hay	10 lbs. Johnson grass hay	12 lbs. Johnson grass hay
umber of mules	5	5	5	5
irst Period—March 1, 1924 to ıly 23. 1924 (150 days)				
Average initial weight (lbs.)	1162.	1145.	1065.	1072.
Average final weight (lbs.)	1222.	1221.	1040.	1076.
Gain or loss in weight (lbs.)	60.	76.	-25.	4.
Total mule days worked	445.8	430.6	489.7	502.1
econd Period—Lots I and II—ugust 18, 1924 to January 15, 925, (150 days)				
ots III and IV—Sept. 16, 1924 February 13, 1925 (150 days)				
Average initial weight (lbs.)	1222.	1220.	1102.	1078.
Average final weight (lbs.)	1267.	1289.	1088.	1085.
Gain or loss in weight (lbs.)	45.	69.	-14.	7.
Total mule days worked	334.4	346.3	347.4	356.4

The mules in Lots I and II and Lots III and IV were reversed for the second period to eliminate the factor of individual variation.

It will be noted that the days worked by Lots I and II and Lots III and IV were practically the same. The differences are not great enough to be of significance.

A detailed study of the changes in body weights throughout the experiment, together with the influences of the work and the temperatures on these changes, is brought out by the curves in the following figures. Figures 1 and 2 give the results for the two periods of five months each for Lots I and II, and Figures 3 and 4 give the same information for Lots III and IV.

The curves of the following four figures show a definite correlation of the body weight and the amount of work the mules were doing throughout the experiment. Evidently the temperature influenced the changes in body weight to some extent.

The slight irregularities in the curves showing the average weights for the mules in each of the lots may be explained in most cases by the amount of work that the mules were doing or the change in temperatures for the period when the weight fluctuations occur.

In Figure 1, the asterisk on the ear corn-Johnson grass hay lot for June 16 indicates the point in the experiment when Red Rock, weighing 1112 pounds, replaced the mule, Henry, weighing 1190 pounds.

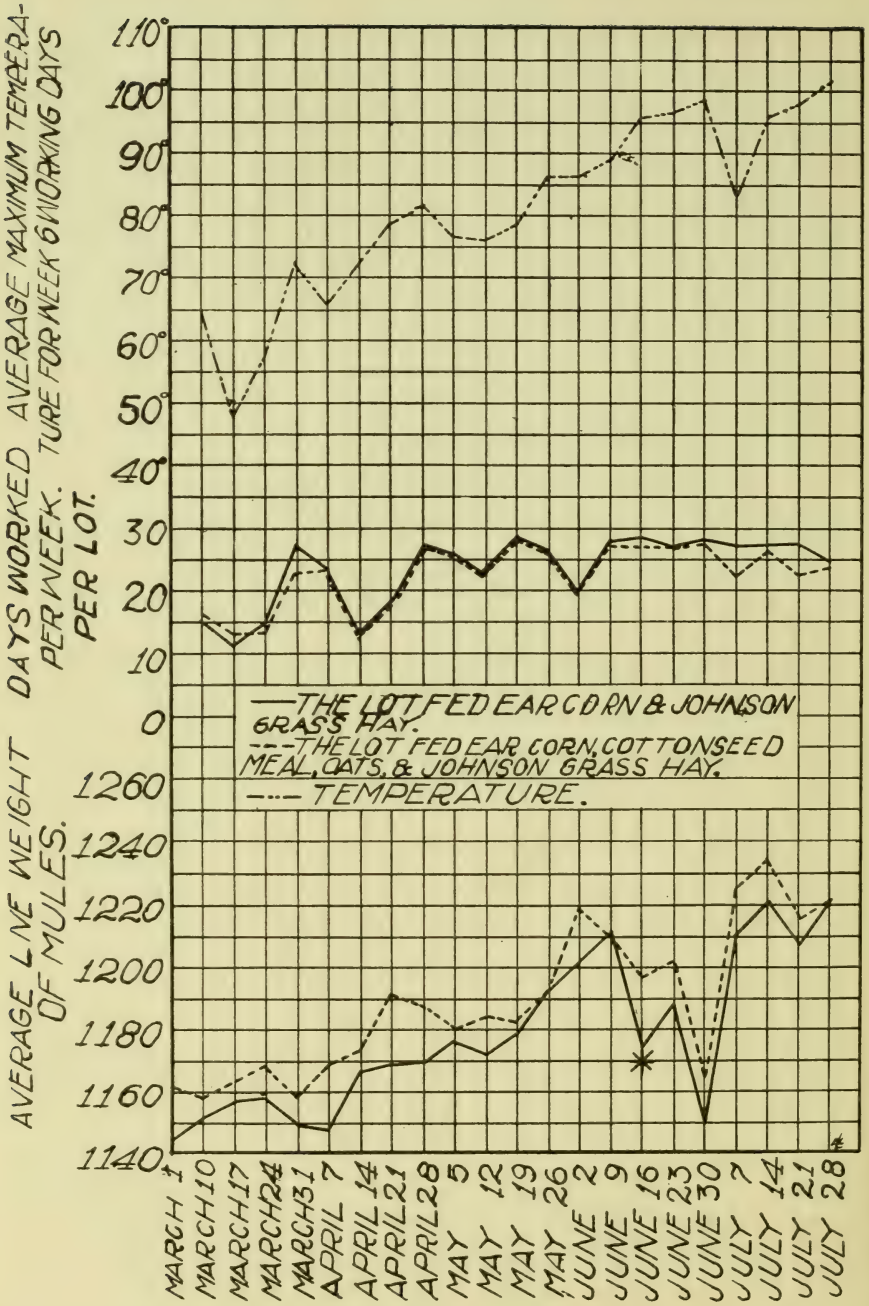

Figure 1—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the first period of the experiment.

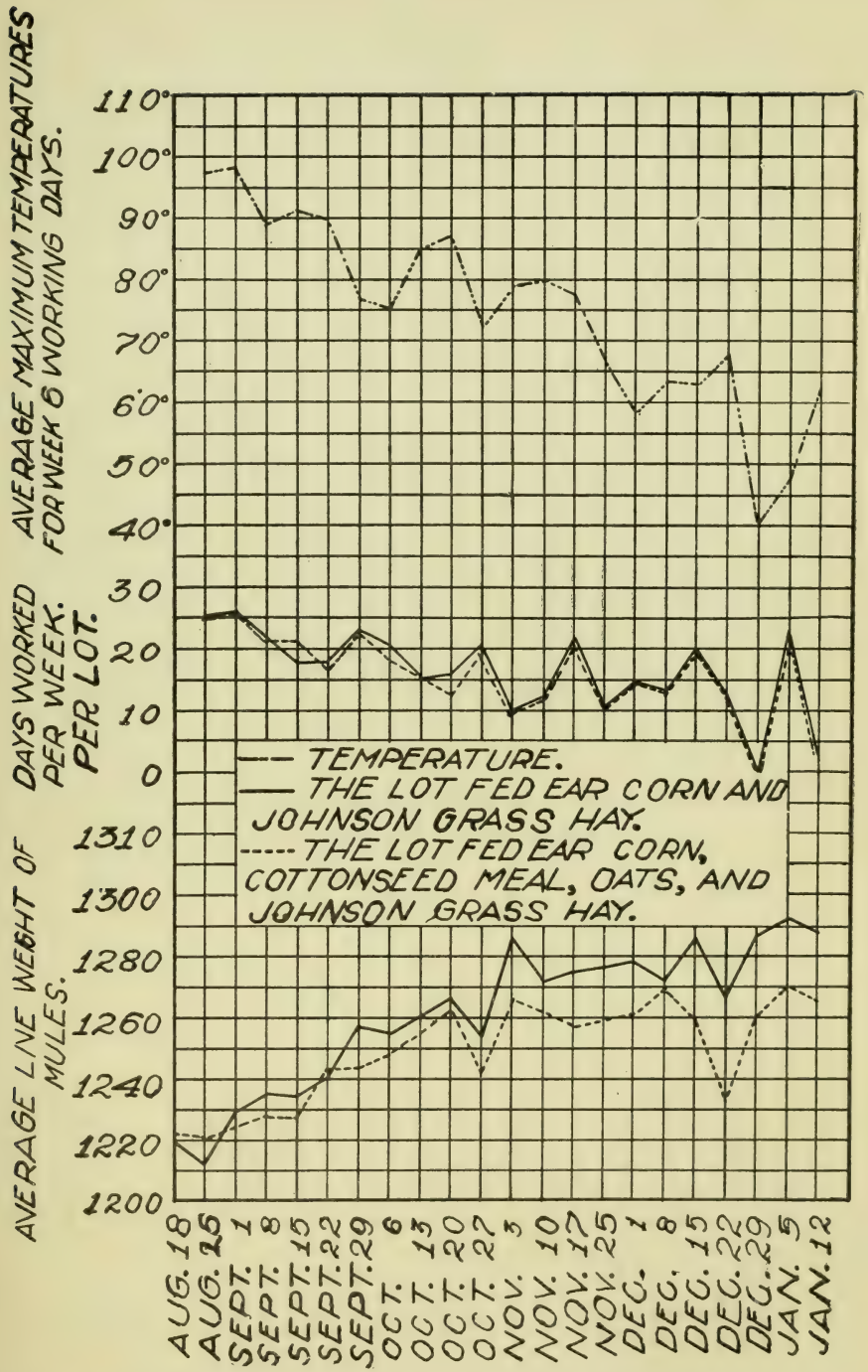

Figure 2—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the second period of the experiment.

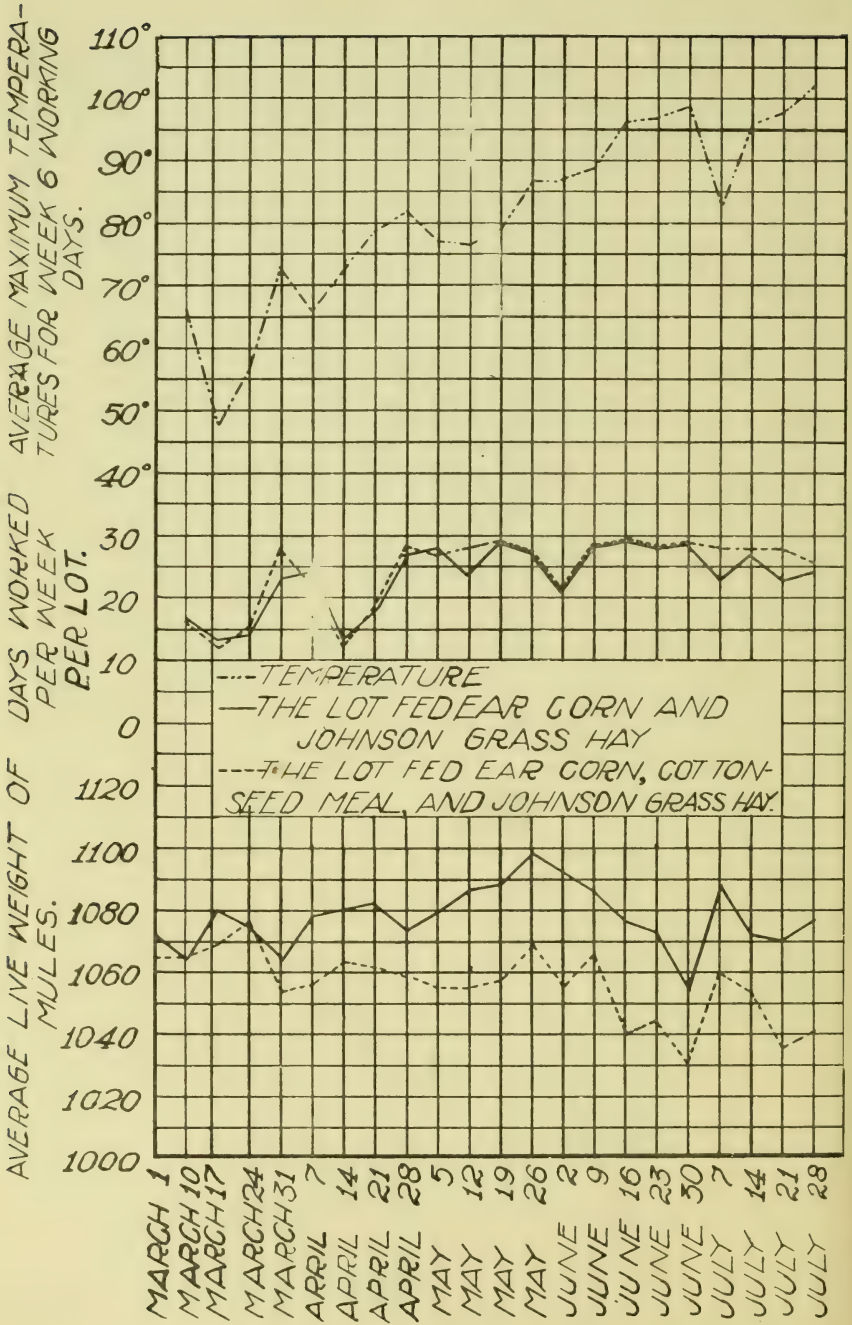

Figure 3--Curves showing average weights for mules in Lots III and IV, days worked, and average maximum temperatures for the first period of the experiment.

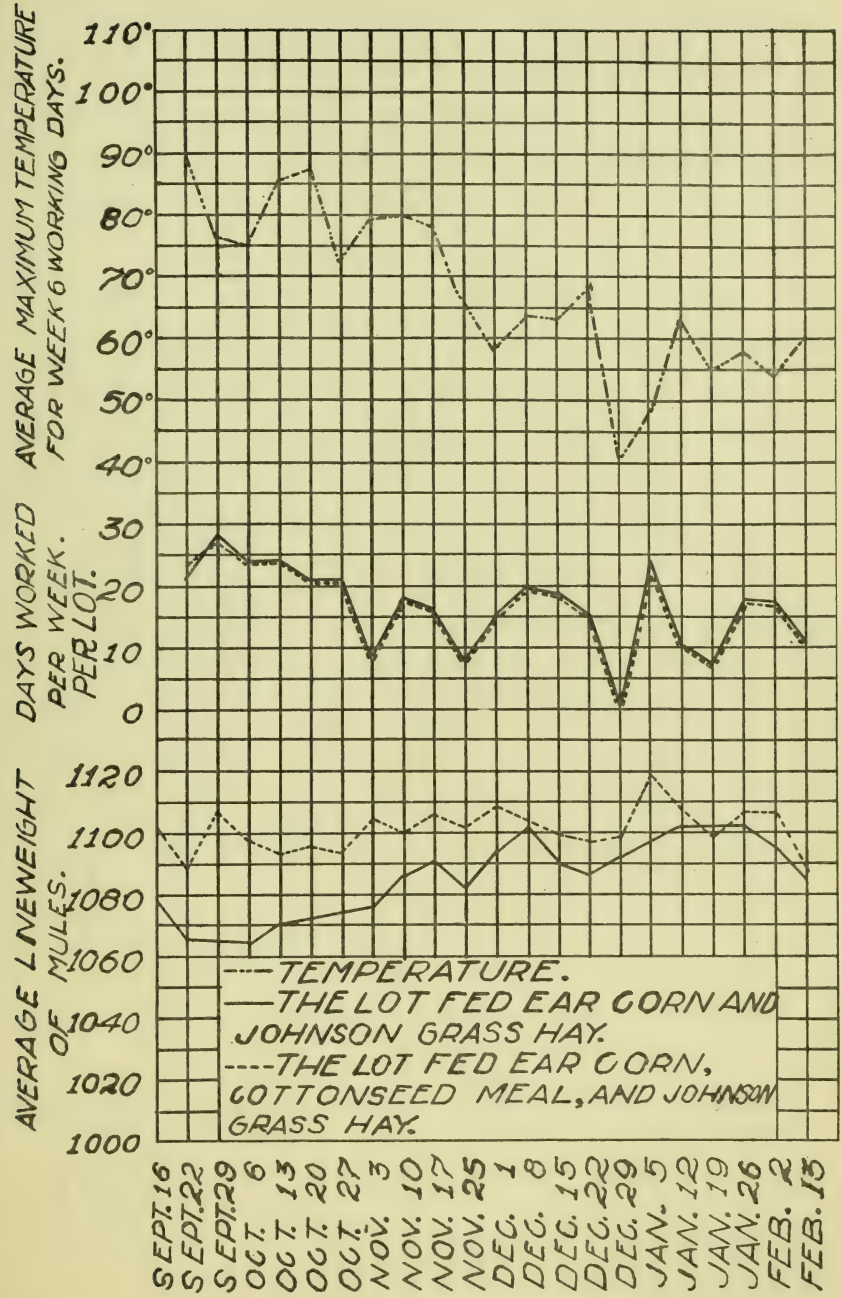

Figure 4—Curves showing average weights for mules in Lots III and IV, days worked, and average maximum temperatures for the second period of the experiment.

Figures 1 and 2 show a gradual increase in live weight through the two periods of five months each for both lots of the mules. The curves for the ear corn—cottonseed meal lot (Lot III) for the two periods of five months each are shown in Figures 3 and 4. This ration is slightly deficient and did not maintain the live weight of the mules of this lot, there being an average loss in live weight for the two periods of 19 pounds.

The curves for the two periods for the ear corn—Johnson grass hay lot (Lot IV) indicate that this ration was satisfactory for maintaining the mules doing heavy work.

Maintenance of Health and Ability to Endure Work and Hot Weather. During the entire period of experiment, there was no case of illness or derangement directly traceable to the rations the mules received. Occasionally some of the mules were "off fed" for a meal or two, but in all cases a temporary reduction of the amount of feed restored the appetite. On each date, April 20 and May 5, Jessie had a case of colic. On June 7, Jane had a similar attack. Both of these mules were receiving a ration of ear corn and hay on these dates. The previous records on these two individuals show that they were susceptible to colic. On June 11, Henry was over-heated and died that night with a typical case of heat prostration. Two years before, he had suffered a sun stroke. On warm days, he showed evidence of being more susceptible to the heat than the other mules in the test.

There was no noticeable difference between the mules of the four lots as to the way they stood their work and the heat. All four rations proved satisfactory in these respects.

Observations on Mules Fed the Cottonseed Meal Rations. The ten mules fed the ration of ear corn, oats, and cottonseed meal consumed their feed with apparent relish. No difficulty was experienced in putting these mules on this ration. The ten mules fed the ration of ear corn and cottonseed meal showed a marked difference among the various individuals as to the palatability of the meal. Four of the 10 mules ate the ration readily and would have consumed more meal. Six of the 10 refused to consume more than 1.1 pounds of meal per thousand pounds live weight. In some cases, it was necessary to increase the amount of meal very gradually for several days up to this amount, then reduce the amount, and raise it gradually again until they became accustomed to the meal. Usually after about three weeks time, all of the 10 mules consumed regularly the 1.1 pounds cottonseed meal per thousand pounds live weight.

There was no difference in the condition of the coats of hair of the mules in the lots consuming cottonseed meal as compared with the mules that did not receive the meal. There was apparently more difference in the glossiness of the coat of hair of the individual mule, the difference depending on the condition and vitality, than there was between the lots.

The following table summarizes the results of the experiment:

ble 2—SUMMARY OF DATA ON FEEDING COTTONSEED MEAL TO WORK MULES FOR TWO 150-DAY PERIODS

Ration 1000 lbs. live weight per day	Lot I 10.26 lbs. Ear corn 1 lb. C. S. M. 3 lbs. Oats 15 lbs. Johnson grass hay	Lot II 16 lbs. Ear corn 15 lbs. Johnson grass hay	Lot III 11.4 lbs. Ear corn 1.1 lbs. C. S. M. 10 lbs. Johnson grass hay	Lot IV 13.7 lbs. Ear corn 12 lbs. Johnson grass hay
mber of mules	5.	5.	5.	5.
ngth of period (days)	300.	300.	300.	300.
tal mule days worked	780.2	776.9	837.1	858.5
erage initial weight (lbs.)	1192.	1182.	1083.	1075.
erage final weight (lbs.)	1244.	1255.	1064.	1080.
erage gain or loss in wt. (lbs.)	52.	73.	-19.	5.
y matter in ration (lbs.)	25.189	26.015	18.957	21.528
rest, crude protein in ration (lbs.)	1.771	1.485	1.447	1.248
restible nutrients in ration (lbs.)	18.122	19.513	14.440	16.296
tritive ratio	1 : 9.23	1 : 12.14	1 : 8.97	1 : 12.05
onsumption of feed per year on basis of 1000 lbs. live weight				
Ear corn (lbs.)	3170.	4944.	3521.	4233.
Cottonseed meal (lbs.)	365.	.....	400.	.....
Oats (lbs.)	1095.	.....	.....	.....
Johnson grass hay (lbs.)	5475.	5475.	3650.	4380.
st of ration per year	$107.90	$100.78	$ 78.18	$ 84.44
st of ration per day	$ .317	$ .31	$ .238	$ .26

Cost of Feeds

rn	$ .87 per bushel
ts	$ .71 per bushel
ttonseed meal	$39.50 per ton
nson grass hay	$12.00 per ton

early consumption of feed is based on the average number of days worked by the four lots. On this basis, each mule worked 198 days and was idle 167 days.

The prices of feeds used in this report represent an average of prices over a period of 10 years time.

In both instances Lots II and IV, receiving the ration with the wider nutritive ratio and slightly larger total digestible nutrients, maintained the weights of the mules better or put on more gain in live weight than the lots receiving the ration with the narrower nutritive ratio.

The ration for Lot II, consisting of ear corn as the sole concentrate, cost slightly less than the ration for Lot I, containing ear corn, cottonseed meal, and oats. The ration for Lot II also was slightly more efficient in putting the mules in better condition, as this lot of mules gained on the average 21 pounds more in live weight during the test than the mules in Lot I.

The ration for Lot IV, fed ear corn, cost 2.2 cents per day per mule more than the ration of ear corn and cottonseed meal fed to Lot III. The ration fed Lot IV contained a larger amount of total digestible nutrients, and this ration was slightly more efficient in maintaining the weights of the mules.

PART II

JOHNSON GRASS VERSUS SOYBEAN HAY FOR FEEDING WORK MULES

There has been an enormous increase in the acreage planted to soybeans in Mississippi and throughout the South during the past four years. With the large number of varieties that are available, it is possible to select one that is adapted to almost any soil type or condition in the South; and it is possible, by utilizing the different varieties, to plant this crop from the middle of March to the middle of July.

The soybean gives a larger tonnage of hay per acre than any other annual legume hay crop grown in this territory. This crop is practically free of diseases and parasites, and the plant is not affected by periods of drouth or excessive moisture as are most of the legumes grown in this section. The soybean is an excellent crop for building up depleted soils.

At the present time, there are no official hay standards for soybean hay, and with the increasing tonnage that is being produced each year, there is a demand for information as to the relative feeding value of this hay.

The following tabulation gives the digestible nutrients in the principal legume and grass hays that are fed in the South*:

	Total Dry Matter in 100 lbs.	Digestible Nutrients in 100 lbs.			
		Crude Protein	Carbohydrates	Fat	Total
Hay from the legumes—					
Alfalfa, all analyses	91.4	10.6	39.0	0.9	51.6
Soybean	91.4	11.7	39.2	1.2	53.6
Cowpea, all analyses	90.3	13.1	33.7	1.0	49.0
Lespedeza	88.2	8.6	41.1	1.1	52.2
Peanut vine, mowed	81.9	7.0	38.4	3.3	52.8
Hays from the grasses—					
Johnson grass	89.9	2.9	45.0	1.0	50.1
Bermuda grass	90.3	3.7	37.9	0.8	43.4
Timothy, all analyses	88.4	3.0	42.8	1.2	48.5

Official hay standards have been adopted for Johnson grass hay, and as this crop is grown and fed extensively in the South, an experiment was planned to test the relative feeding value of soybean hay and Johnson grass hay.

OBJECT OF THE EXPERIMENT

The object of this experiment was to compare the relative feeding value of soybean hay and Johnson grass hay for feeding mature mules doing heavy work.

*Feeds and Feeding, 18th edition.

PLAN OF THE INVESTIGATION

Five pairs of mules were used in this experiment. They were divided into two lots in such a manner as to place team mates in Lot I and in Lot II. The rations for the two lots were as follows:

Lot I—Ear corn and Johnson grass hay.

Lot II—Ear corn and soybean hay.

Two periods of five months each were used in this test. The first period started on March 2, 1925, and was concluded on July 29, 1925. At the close of the first period, most of the mules used in the test were turned on pasture for the month of August. The first of September, both lots of mules were put on feed, the lots being reversed so that the mules that were fed the Johnson grass hay for the first five months received the ration with soybean hay during the last five months of the test.

Two weeks were utilized in putting the mules on feed, and the second period of the experiment started on September 14, 1925, and concluded on February 10, 1926, a total of 150 days. The reversal of the two lots for the second period was made to eliminate so far as possible the factor of individuality among the mules in the lots being compared.

MULES USED

The 10 head of mules used in this experiment are the same individuals that were used in Lots I and II in the cottonseed-meal-feeding experiment the previous year.

The following list gives the age and average weight of the mules of each of these pairs at the beginning of the experiment:

Name			
Lot I	Lot II	Age	Weight
Alice		9	1110
	Will	5	1216
Pigeon		7	1246
	Blue	9	1180
Pat		5	1248
	Fly	7	1175
Nell		10	1326
	Jessie	8	1303
Red Rock		5	1202
	George	8	1228

The mules in these two lots were carrying the desired amount of flesh, and the rations for the test were figured on the basis of maintaining as nearly as possible the initial weights of the mules in the two lots.

FEEDS USED

The Mosby corn used in this test was raised on the Station farm. Because of a drouth, the ears were somewhat smaller than the corn used

in the previous year's test. On the average, the ears weighed about three to the pound, and 64 pounds of ear corn were required to shell out 56 pounds, or one bushel of shelled corn.

The Otootan soybean hay used in the experiment was raised with corn, the beans being planted in alternate rows. It was planned to use the bean crop for soil improvement. On account of the drouth, it became necessary to save the soybean crop for feeding purposes. The corn crop that was grown with the beans was put into the silo and the soybeans were cut and cured for hay. The beans had made a very rank growth and were very stemmy. At the time of cutting, a large number of the beans were mature. In the curing processes, the leaves adhered to the stems, and the hay was green in color. The Johnson grass hay was raised on the Station farm and was of good quality. Most of the crop that was fed in this experiment graded Number 1, with a small amount grading Number 2.

PERCENTAGE COMPOSITION OF FEEDS USED

	Water	Ash	Protein	Crude Fiber	Nitrogen Free Extract	Fat
Corn	9.20	1.25	9.63	3.20	72.17	4.55
Johnson grass hay	7.00	5.68	5.75	31.66	48.10	1.81
Soybean hay	7.92	6.60	9.87	36.26	36.54	2.89

FEEDING AND MANAGEMENT

The mules were fed in individual box stalls. The grain was fed in equal amounts morning, noon, and night. The hay was all fed at night. The mules had free access to salt at all times. When working, the mules were given water when they were taken from the stalls and when they returned from work. On Sundays and idle days, the noon feed was omitted. When not at work, the mules were fed their regular ration morning and evening and turned on a pasture. During the warm season, they were turned out at night after they had finished eating.

Records and accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights of the mules consisted of an average of three weights made on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered. Records were kept of the number of days that each mule worked, and of the health of the mules, and of any unusual circumstances which occurred during the experiment.

RESULTS OF THE INVESTIGATION

Rations Fed, Weight Records, and Days Worked. In the previous year's work the ration for Lot IV, consisting of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per thousand pounds live weight per day, maintained the weight of the mules very satisfactorily throughout the year; so this ration was used for Lot I for the present experiment. In figuring the ration for Lot II, the same amount of ear corn was utilized

as for Lot I, and enough soybean hay was used in the ration to make the total digestible nutrients for the two lots as nearly equal as possible.

As the growth of the soybean crop was very rank and stemmy, some of the largest stems measuring ⅜ inch at the base, considerable waste in feeding the bean hay was anticipated. As the amount of roughage for both lots was limited, the Johnson grass hay was consumed without any waste whatever, and there was not enough waste of the soybean hay to be considered a factor in the experiment. Samples of the soybean hay utilized in this test were fed to some mature sheep, and the sheep refused forty per cent of the hay.

Table 3 summarizes the results of this experiment for the rations fed, weights of the mules, and record of the days worked.

Table 3—RATIONS FED, WEIGHT RECORDS, AND DAYS WORKED

Per 1000 lbs. live weight per day	Lot I 13.7 lbs. Ear corn 12 lbs. Johnson grass hay	Lot II 13.7 lbs. Ear corn 11 lbs. Soybean hay
Number of mules	5.	5.
First Period—March 2 to July 29, 1925		
Average initial weight (lbs.)	1226.	1220.
Average final weight (lbs.)	1230.	1254.
Gain or loss in weight (lbs.)	4.	34.
Total mule days worked	479.	459.
Second Period—September 14, 1925, to February 10, 1926		
Average initial weight (lbs.)	1273.	1247.
Average final weight (lbs.)	1262.	1278.
Gain or loss in weight (lbs.)	-11.	31.
Total mule days worked	300.2	274.7

The mules in Lots I and II were reversed for the second period to eliminate the factor of individual variation.

It will be noted from the foregoing table that the soybean ration was slightly more efficient in maintaining the weight of the mules than the Johnson grass hay ration.

By referring to charts, Numbers 5 and 6, it will be noted that for the last few days of both feeding periods, the Johnson grass hay lot of mules dropped in live weight, and for the same period the soybean mules were increasing in live weight. By comparing the average live weight for the mules in both lots throughout the 10 months period of the experiment, it will be seen that there was little difference in the efficiency of the two rations in maintaining the weight of the mules. The mules in the Johnson grass hay lot, however, worked slightly more total number of days than did the mules in the soybean lot. The changes in body weight throughout the experiment, together with the influence of the work and the temperatures of these changes, are shown by the curves in the following figures:

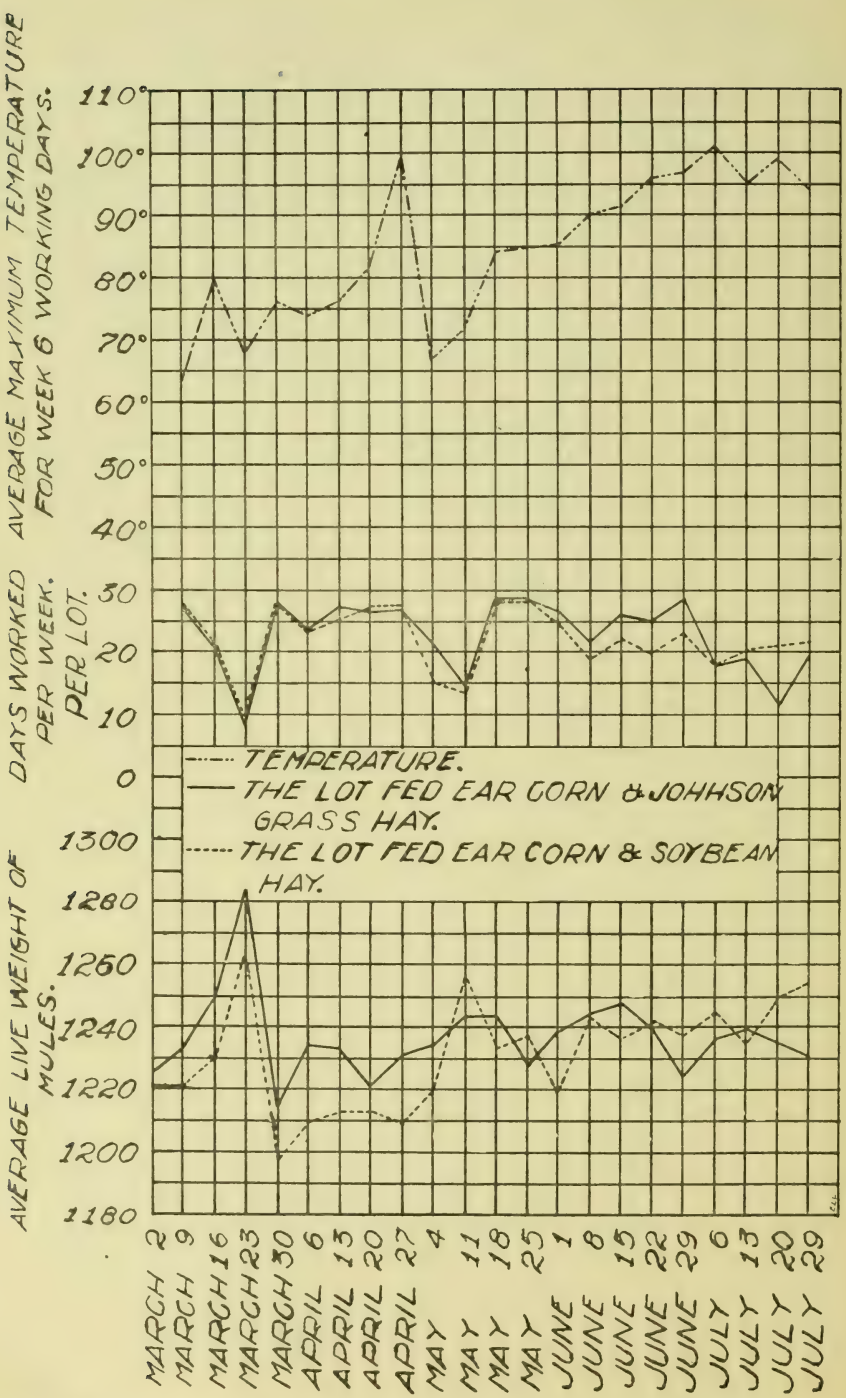

Figure 5—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the first period of the experiment.

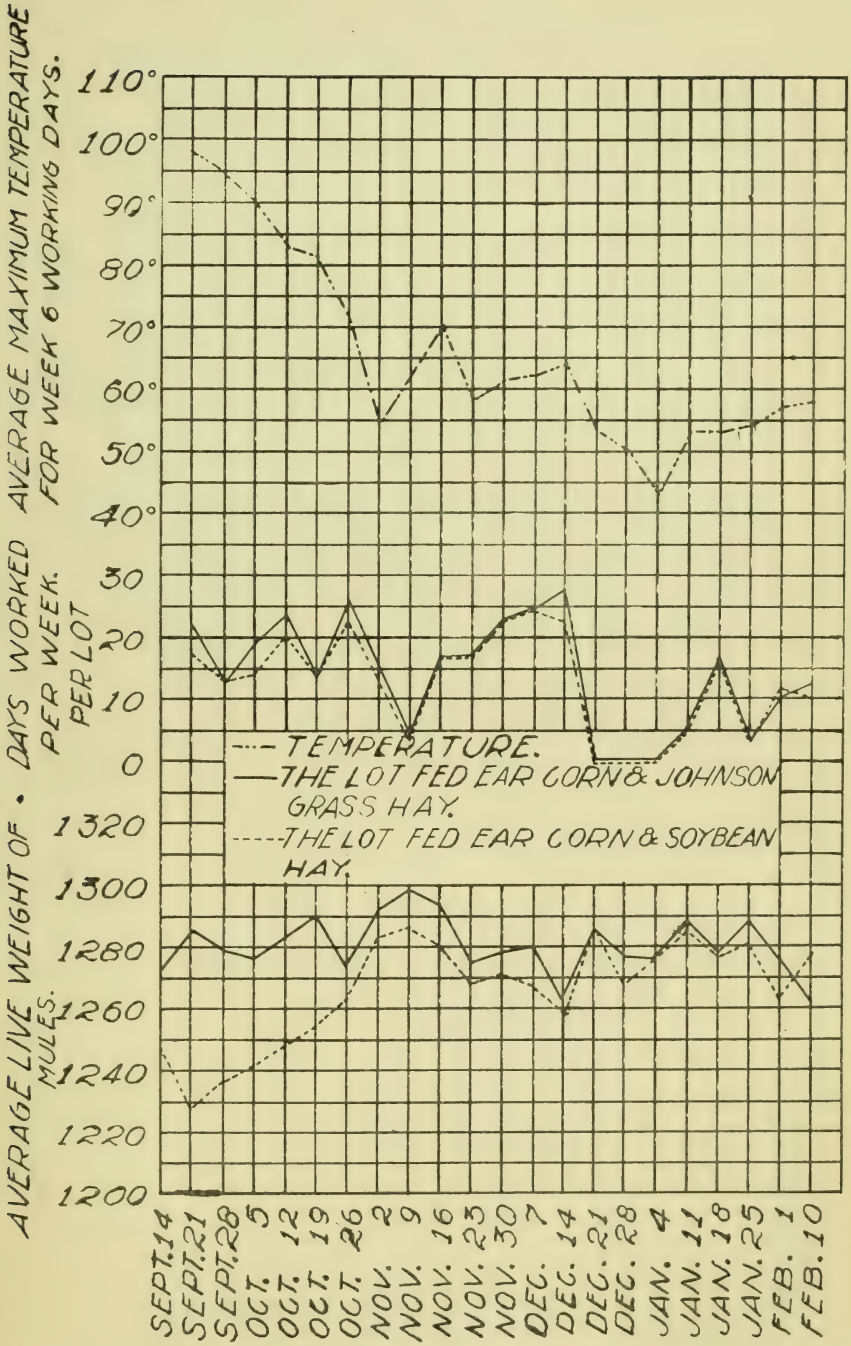

Figure 6—Curves showing average weights for mules in Lots I and II, days worked, and average maximum temperatures for the second period of the experiment.

The curves in Figures 5 and 6 show a close correlation of the body weight of the mules and the amount of work that they were doing throughout the experiment. There is also a marked influence in the change in body weight at certain periods during the experiment, due to the temperatures. For instance, during the week of March 16, temperatures made a drop of about 15 degrees and the mules were doing very little work at that time. Consequently, there is a marked increase in the body weight.

It will be noted in the second period of the experiment that the dotted line, showing the average weight for the mules consuming the soybean ration, dropped considerably during the week of September 21. This curve gradually approached the curve for the Johnson grass hay group until October 19. The variation for the soybean hay group during this period may be explained by the fact that the mule Pigeon for some unexplainable reason, was "off feed" the week of September 21 and her live weight dropped from 1272 pounds to 1220 pounds. As she went back to a normal ration, her body weight became normal again.

Maintenance of Health and Ability to Endure Work and Hot Weather. During the entire period of the experiment, there was no case of illness that could be traced to the rations that the mules received. Both rations were palatable and satisfactory. However, it was apparent that the soybean hay was relished more by the mules than was the Johnson grass hay. There was no noticeable difference between the mules of the two lots as to the way they stood their work and the heat, nor was there any difference in the spirit of the two lots.

Pat suffered from a case of colic on the second, the fourteenth, and the twenty-fifth of April, and again on the third of May. During this time, this mule was consuming the Johnson grass hay ration. On the seventeenth day of July, Pat was operated on to remove a growth from the right fore flank. The mule was unable to work for 18 days following the operation. Alice did no work for 14 days during the first period of the test because of an infection in the foot. All of the mules in both lots consumed their rations regularly during the second period, except Pigeon in the soybean lot. This mule was "off feed" from September 19 to October 10.

The changes in live weight for the two lots, as indicated in the following table, are slightly misleading. The average loss of three pounds by the Johnson grass hay mules for the two periods and the average gain of 33 pounds for the soybean mules for the same time may be explained in part by the variations that occurred in these two lots for the last two weeks of both periods. By referring to Figures 5 and 6, it will be noted that the Johnson grass lot lost weight for the last two weeks of both periods, while the soybean lot gained weight for the last two weeks of the first period and the last two weeks of the second period.

The following table summarizes the result of the experiment:

Table 4—SUMMARY OF DATA ON THE RELATIVE FEEDING VALUE OF JOHNSON GRASS HAY AND SOYBEAN HAY

Ration Per 1000 lbs. live weight per day	Lot I 13.7 lbs. Ear corn 12 lbs. Johnson grass hay	Lot II 13.7 lbs. Ear corn 11 lbs. Soybean hay
Number of mules	5	5.
Length of period (days)	300.	300.
Total mule days worked	779.2	733.7
Average initial weight (lbs.)	1249.	1233.
Average final weight (lbs.)	1246.	1266.
Average gain or loss in weight (lbs.)	-3.	33.
Dry matter in ration (lbs.)	21.528	20.794
Digestible crude protein in ration (lbs.)	1.248	2.187
Digestible nutrients in ration (lbs.)	16.296	16.180
Nutritive ratio	1 : 12.05	1 : 6.39
*Estimated consumption of feed per year on basis of 1000 lbs. live weight		
Ear corn (lbs.)	4169.	4169.
Johnson grass hay (lbs.)	4380.	.....
Soybean hay (lbs.)	.....	4015.
Cost of ration per year	$83.56	$83.56
Cost of ration per day	26.02 cts.	26.02 cts.

Cost of Feeds

Corn	$ .87 per bushel
Johnson grass hay	$12.00 per ton
Soybean hay	$13.09 per ton

On the basis of this experiment, one ton of soybean hay would be worth $13.09 with Johnson grass hay costing $12 per ton.

*Mules were fed on the basis of their live weight. On idle days the noon feed of concentrates was omitted.

The curves showing the changes in body weight for the two periods of five months show very clearly that there is little, if any, difference in the efficiency in these two rations in maintaining the live weight of the mules while doing heavy work.

There was no noticeable difference in the spirit or their ability to stand work and heat of the mules consuming the ear corn—Johnson grass hay ration, with a nutritive ratio of 1 : 12.05 that contained 16.29 pounds of digestible nutrients, and the mules fed the ear corn—soybean ration with a nutritive ratio of 1 : 6.39 that contained 16.18 pounds of digestible nutrients.

On the basis of this experiment, 12 pounds of Johnson grass hay was the equivalent of 11 pounds of soybean hay. With the prevailing prices of 87 cents per bushel for corn and $12 a ton for Johnson grass hay, the soybean hay was worth $13.09 per ton.

PART III

STALL VERSUS LOT FEEDING OF WORK MULES

There are two systems of feeding mules in use in the South. On the small farms and plantations, mules are generally fed individually in stalls, but on the large farms and plantations, in lumber camps, and with construction outfits, large numbers of work mules are fed in lots.

In lot feeding, the principle involved is to feed enough concentrate and roughage each day so that the mules have access to the feed at all times. Some feeders make a practice of putting out enough feed at one time to last for a day, while others put the feed in the lots twice a day. The usual practice in both cases is to have a small amount of feed left over for the next feeding period to insure the weaker, more timid, and younger mules securing their portion. Mules accustomed to this system of feeding suffer very little from digestive disorders after they are on full feed. It would seem that this system of feeding would be rather wasteful in that in all probability the mules would consume more feed than was necessary to maintain them in proper condition. In comparing the two systems, some feeders claim that the time saved in feeding under the lot-fed system would more than offset any saving in feed that would be brought about by stall-feeding the mules.

In the stall-feeding of mules, it would be easier to detect mules that were "off feed," and consequently they could be given proper treatment more promptly than if the mules were being lot-fed. Feeders who have had considerable experience in stall feeding mules say that they would have less trouble with colic and other digestive disorders by using this system of feeding.

To obtain data on these two systems of feeding, the following experiment was planned.

OBJECT OF THE EXPERIMENT

The object of the experiment was to compare stall versus lot-feeding of mules. Especial attention was given to the following points:

Health of the mules.

Ability to endure hard work and hot weather.

Maintenance of weight and condition.

Degree of spirit maintained.

Economy of the two systems of feeding.

PLAN OF INVESTIGATION

The plan of the experiment was to divide six pairs of mules into two lots in such a manner as to place team mates in Lots III and IV. The rations per thousand pounds live weight per day for the two lots were as follows:

Lot III—Stall Fed—13.7 pounds ear corn and 12 pounds Johnson grass hay.

Lot IV—Lot Fed—Ear corn ad libitum, and Johnson grass hay ad libitum.
(Amount consumed—16.71 pounds of ear corn and 13.52 pounds of Johnson grass hay.)

The mules were used during the experiment to perform the regular farm work on the Experiment Station farm. Team mates were worked together practically all the time. Occasionally it was necessary to split the teams, but during such periods most of the mules were doing the same kind of work.

The first period of the test was started on March 2, 1925, and concluded on July 29. During the month of August most of the mules were on pasture. For the second period of the experiment, the rations were reversed for the two lots, so that during the second period the mules in Lot IV received the ration formerly fed to the mules in Lot III. Two weeks were utilized to place the mules on full feed, and the second period of the test was started on September 14, 1925, and concluded on February 10 1926.

MULES USED

Eight of the 12 mules used in this experiment were the same individuals that were used in the previous year's work in feeding cottonseed meal. Kate and Maude, both mature mules, were purchased on the local market; and Mike and Eva, two young mules that were raised on the Station farm, were added to the lots. The following list gives the ages and average weight of the mules of each pair at the beginning of the experiment:

Name			
Lot III	Lot IV	Age	Weight
Jake		11	1232
	Jane	11	1362
Della		11	1150
	White Nell	10	1112
Mandy		9	1028
	Molly	7	1008
Mike		4	1045
	Eva	3	980
Dave		7	958
	Beck	10	960
Kate		5	1133
	Maude	5	1192

All of the mules in both lots were in good condition when the experiment was inaugurated.

FEEDS USED

The ear corn and Johnson grass hay used in this experiment were of the same quality as used in the test comparing Johnson grass hay and soybean hay.

FEEDING AND MANAGEMENT

The mules in Lot III were fed in individual box stalls. The grain fed to this lot was divided into three equal feeds, the hay all being fed at night. Salt was available to these mules in their stalls at all times. The mules were watered after the morning feed and before the night feed. When working, they were always given water when they were taken from their stalls and when they returned from work. On Sundays and on idle days, the noon feed was omitted. When not at work, the mules in this lot were turned into a dry lot for exercise. During the warm season, the mules in Lot III were turned out at night after they had finished eating.

The mules in Lot IV were fed the grain part of their ration in two feeds, at noon and night, the larger part of the grain being fed at the evening meal. Hay was fed at night. Enough corn and hay were fed at each feeding period so that there would be a small amount of feed left over for the next meal. The mules had free access to salt and water.

The lot in which these mules were confined during the test was 50 by 60 feet. A shed 12 by 60 feet was on the north side of the lot. A feed trough 24 feet long and a hay rack 20 feet long under the shed were utilized for feeding.

Time Required to Feed the Two Lots. The time required to feed the mules under these two systems would vary according to the conveniences for doing the work, but in this experiment 26 minutes were required each day for feeding the stall-fed mules and 16 minutes for the lot-fed mules.

RECORDS

Accurate weights of all feeds offered and refused were kept during the experiment. The initial and final weights here presented consist of an average of three weights taken on consecutive days. Individual weights were taken of the mules every Monday morning after they were fed and watered. Records were kept of the number of days each mule worked and of the health of the mules and of any unusual circumstances which occurred during the experiment.

RESULTS OF THE INVESTIGATION

Rations Fed, Weight Records, and Days Worked. The ration fed to Lot III, consisting of 13.7 pounds of ear corn and 12 pounds of Johnson grass hay per thousand pounds live weight per day, was used in the two

previous experiments reported in this bulletin, and this ration was used for a check lot in this test. The lot-fed mules were fed according to their appetites, and on the average consumed about the same amount of hay as the stall fed mules, but they consumed 21.9 per cent more grain than the stall-fed mules.

Table 5 summarizes the results of this experiment for the rations fed, weights of the mules, and record of days worked:

Table 5—RATIONS FED, WEIGHT RECORDS, AND DAYS WORKED

Ration Per 1000 lbs. live weight per day	Lot III Stall Fed 13.7 lbs. Earn corn 12 lbs. Johnson grass hay	Lot IV Lot Fed Ear corn ad libitum Johnson grass hay ad libitum
Number of mules	6.	6.
First Period		
March 2 to July 29, 1925		
Average initial weight (lbs.)	1091.	1101.
Average final weight (lbs.)	1103.	1181.
Gain or loss in weight (lbs.)	12.	80.
Total mule days worked	601.3	560.8
Second Period		
September 14, 1925 to February 10, 1926		
Average initial weight (lbs.)	1182.	1134.
Average final weight (lbs.)	1131.	1220.
Gain or loss in weight (lbs.)	-51.	86.
Total mule days worked	404.5	372.0

The mules in Lots III and IV were reversed for the second period to eliminate the factor of individual variation.

The ration for Lot III was very satisfactory for maintaining the weight of the mules in this lot for the first period of the test, but during the second period the mules lost on the average 51 pounds. The mules that were lot-fed gained an average of 83 pounds for the two periods. The stall-fed mules worked 404½ days during the test, and the lot-fed mules worked a total of 372 days.

A detail study of the changes in body weights throughout the experiment, together with the influences of the work and the temperatures on these changes, is brought out by the curves in the following figures. Figure 7 gives the results for the first period of five months for the two lots, and Figure 8 summarizes the same information for the two lots for the second period of five months:

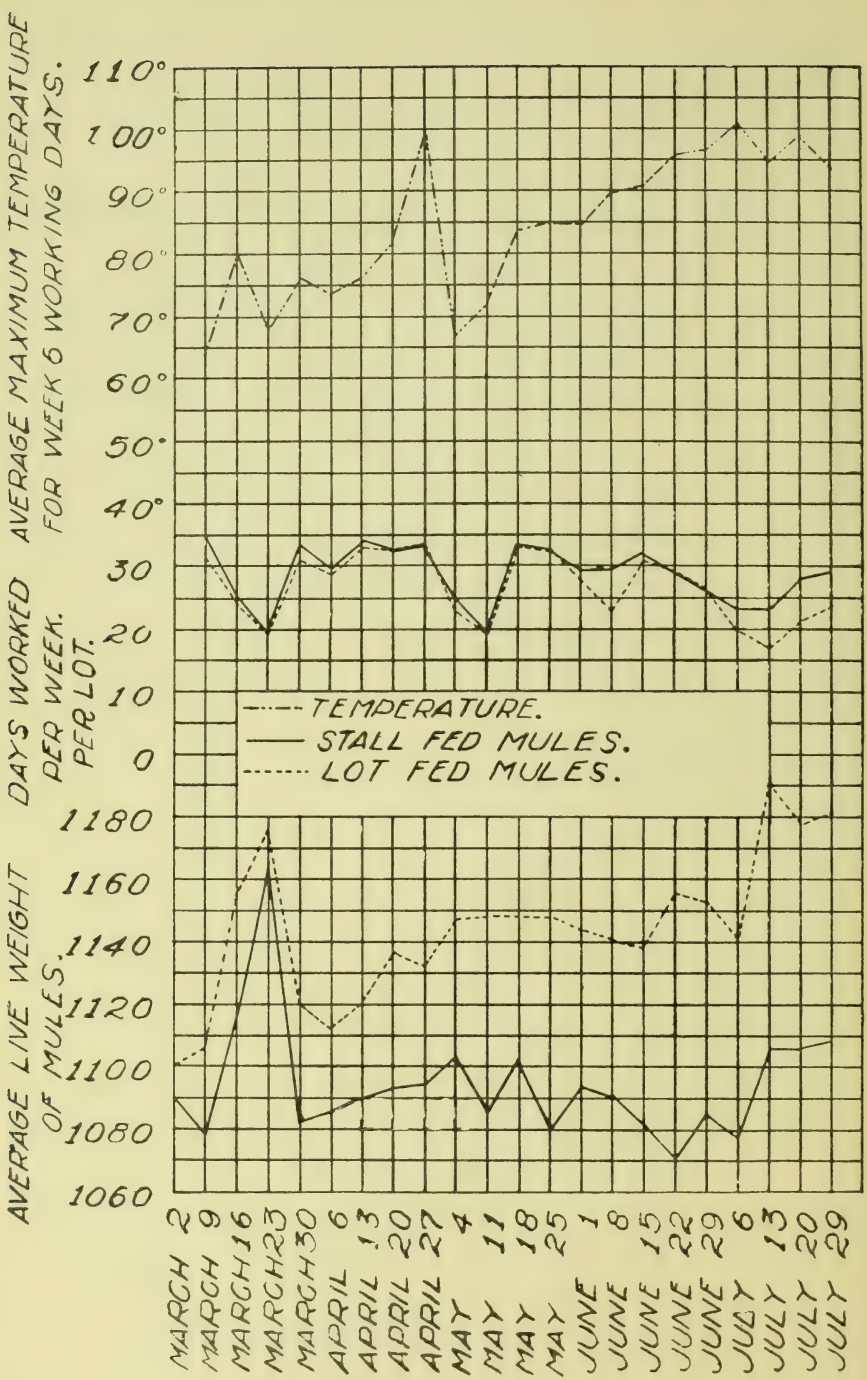

Figure 7—Curves showing average weights for the mules in Lots III and IV, days worked, and average maximum temperatures for the first period of the experiment.

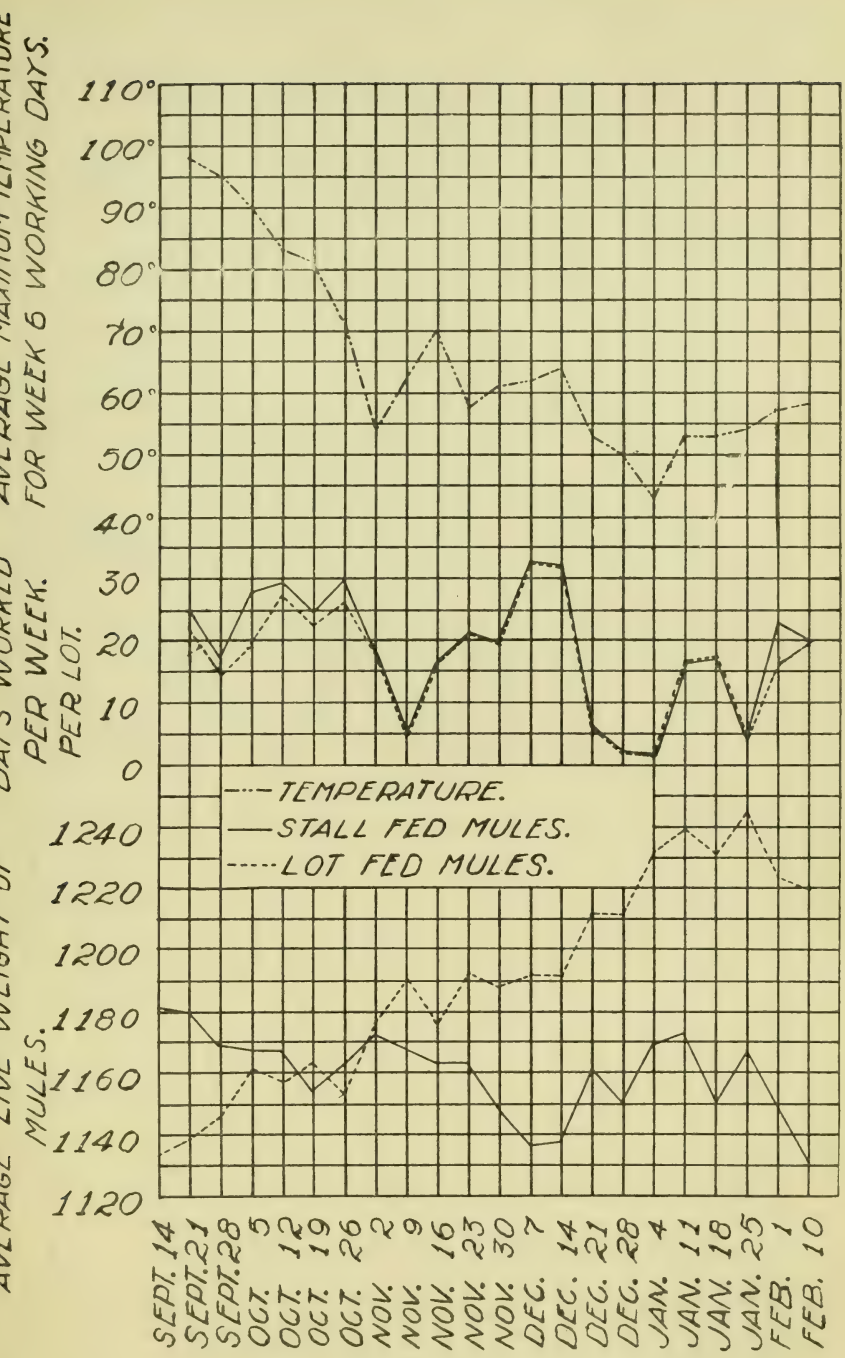

Figure 8—Curves showing average weights for the mules in Lots III and IV, days worked, and average maximum temperatures for the second period of the experiment.

The weight curves in the preceding figures show a consistent increase in weight during both periods for the lot-fed mules, as compared with their team mates being fed in the stalls. Slight variations appear in the weight curves in both periods, but for the most part these variations can be accounted for by the amount of work that the mules in the two lots were doing and by the changes in temperatures at the time the variations in the weight of the mules occur.

Maintenance of Health and Ability to Endure Work and Hot Weather.

During the entire period of the experiment, there was no case of illness or digestive derangements of any kind. On October 5, a growth was removed from Della's shoulder and this mule did no work for six weeks. There was no noticeable difference in the spirit of the mules of the two lots or as to the way they stood their work and the heat. Both rations proved satisfactory in these respects.

The following table summarizes the results of this experiment:

Table 6—SUMMARY OF DATA ON STALL VERSUS LOT FEEDING OF MULES

Ration Per 1000 lbs. live weight per day	Lot III Stall Fed 13.7 lbs. Ear corn 12 lbs. Johnson grass hay	Lot IV Lot Fed Ear corn ad libitum Johnson grass hay ad libitum
Number of mules	6.	6.
Length of period (days)	300.	300.
Total mule days worked	1005.8	932.8
Average initial weight (lbs.)	1136.	1117.
Average final weight (lbs.)	1117.	1200.
Average gain or loss in weight (lbs.)	-19.	83.
Dry matter in ration (lbs.)	21.528	25.023
Digestible crude protein in ration (lbs.)	1.248	1.480
Digestible nutrients in ration (lbs.)	16.296	19.175
Nutritive ratio	1 : 12.05	1 : 11.95
*Consumption of feed per year on basis of 1000 lbs. live weight		
Ear corn (lbs.)	4228.	6102.
Johnson grass hay (lbs.)	4380.	4863.
Cost of ration per year	$84.37	$113.01
Cost of ration per day	26.02 cts.	30.90 cts.

Cost of Feeds

Corn ..... $ .85 per bushel
Johnson grass hay ..... $12.00 per ton

*Mules were fed on the basis of their live weight. On idle days the noon feed of concentrates was omitted.

It will be noted from the foregoing table that the ration of corn and Johnson grass hay fed to the stall-fed mules did not maintain the initial

weight of the mules, as this lot lost an average of 19 pounds for the two periods of five months each. The lot-fed mules gained an average of 83 pounds during the period of the test.

There was no noticeable difference in the ability of the mules of the two lots to do their work or to stand the warm weather, nor was there any difference in the spirit of the mules of the two lots.

The lot-fed mules consumed a ration of 16.71 pounds of ear corn and 13.32 pounds of Johnson grass hay per thousand pounds live weight per day. There was little difference in the total amount of hay consumed in the two lots, but the lot-fed mules consumed 21.9 per cent more corn than the stall-fed mules.

On the basis of this experiment, it cost $84.37 per year to maintain a thousand pound mule doing heavy work when stall-fed, and $113.01 for the mules that are lot-fed.

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BULLETIN No. 245 VEMBER, 1927

A STUDY OF FOOD HABITS OF PEOPLE IN TWO CONTRASTING AREAS OF MISSISSIPPI

By

DOROTHY DICKINS

A Typical Rural Home from the Study. Such homes are simple and economical in construction. Their poorest feature is the lack of household conveniences.

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
AGRICULTURAL COLLEGE, MISSISSIPPI

J. R. RICKS, Director

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A STUDY OF FOOD HABITS OF PEOPLE IN TWO CONTRASTING AREAS OF MISSISSIPPI

INTRODUCTION

Is it true that the poor Mississippi farmer dines daily off of corn-meal, salt pork, and molasses, while his more prosperous neighbor indulges in chicken, candied yams, and corn pone?

Mississippi with its mild climate, abundant sunshine, and rich soil, offers superior advantages for physical health and well being. Yet health reports show that there are still a few states with conditions less fortunate ranking ahead of Mississippi. Perhaps these assets have not been properly utilized.

Conditions in Mississippi are exceptionally favorable for dairying, poultry raising, gardening, and nut growing; that is, for producing those foods which are essential for an adequate and healthful nutrition of its people. Good nutrition is an essential of good health, and a well balanced ration plays an important part in producing good nutrition. Since this is true, it was thought that a study of food habits and of the physical condition of a number of representative Mississippi families might offer an explanation for this difference between facts as they are and facts as they should be.

There are probably certain sections of the state where dietary conditions are not conducive to best health, but a thorough knowledge of conditions must precede any systematic efforts for improvement. Such was the objective of the project which is discussed in this bulletin.

DESCRIPTION

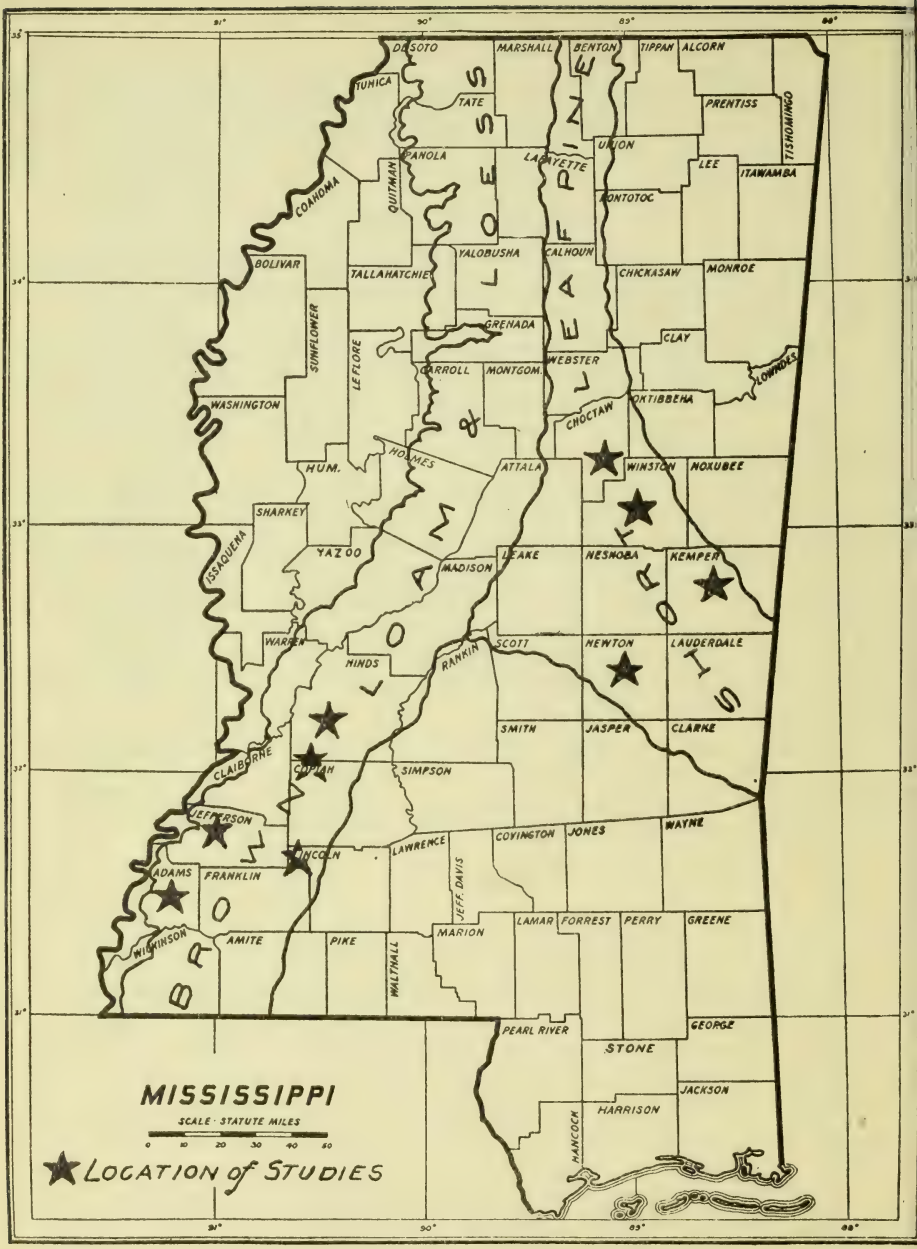
Areas, Counties, Communities.

Two predominating soil areas, the Brown Loam and the Short Leaf Pine were selected for the study. Cotton and corn are grown extensively on both areas, but the Brown Loam area is especially noted for trucking crops. Analyses show the soil of the Brown Loam area to be more fertile than that of the Short Leaf Pine area.

Typical counties from each area were selected. County Agents and Superintendents of Education pointed out typical rural communities in these counties.

It was decided not to enroll more than ten families in any one community, for: (1) the population is so thinly settled in the majority of rural communities that it would have been difficult to get more than ten representative families who were willing to cooperate; (2) ten families seemed all that one supervisor could be responsible for.

Families from only one community in each county were enrolled. It was thought best to spread the study over as large an area as possible, thus making it more representative.



1927

Fig. 1—Map of Mississippi showing location of food consumption studies.

Ten families of a single community were enrolled in each of the following counties: Jefferson, Copiah, Lincoln, Adams, Choctaw, Winston, Kemper, and Newton, the first four being in the Brown Loam area and the remainder in the Short Leaf Pine area.

The study in Adams county was dropped, as it was found that the rural people in this county lived like the Delta people; that is, they were not typical of the people from the Brown Loam area. A study was started in Hinds county to take the place of the one dropped in Adams county.

Supervisors.

An intelligent woman with a means of conveyance was employed in each community to supervise the food consumption studies.

Families Selected.

With the help of the supervisor and the county agent, a list of prospective representative families was made out. A visit was paid each of these families. The study was presented to the housewife in the form of a nutrition project. It was approached from two standpoints: (1) benefits to be derived; (2) what was expected of the families enrolled. Every precaution was taken to select representative families who could be depended on to keep accurate records. This included families in which the housewife or a daughter had the ability to keep a food record.

To be doubly assured that representative families had been enrolled, a further check was used. The children attending the school in the community selected were asked to fill out a record giving name, county, nearest town, and a menu of food served in their homes on the preceding day. These menus were totaled according to use of different foodstuffs. The menus of children from families enrolled were compared with those of the other children. The fact that they closely agreed was taken as another indication that representative families had been selected.

Table 1—Size of Families.

Brown Loam Area			Short Leaf Pine Area		
Families size	F.*	S. F.*	Families size	F.*	S. F.*
3	7	21	3	13	39
4	11	44	4	6	24
5	12	60	5	8	40
6	10	60	6	9	54
7	7	49	7	8	56
8	4	32	8	1	8
9	0	0	9	1	9
10	1	10	10	1	10
11	0	0	11	0	0
12	1	12	12	0	0
Totals	53	288		47	240

* F. means frequency and S. F. means (size x frequency).

A family of five was the most common among the Brown Loam people, while a family of three was most common among the Short Leaf Pine people.

Table 1 includes parents, sons, and daughters who were at home. The dietary studies also include twenty relatives sheltered in these homes. This made a total of 548 people included in the study.

Table 2—Ages of Husbands, Wives, and Children

Age Group	Husbands		Wives		Age Group	Children	
	Brown L. area	Short L. Pine area	Brown L. area	Short L. Pine area		Brown L. area	Short L. Pine area
years	number	number	number	number	years	number	number
20-29	5	6	9	10	under 5	35	35
30-39	17	15	18	15	5-9	54	37
40-49	14	14	22	15	10-14	52	31
50-59	12	7	4	7	15-19	33	32
60-69	3	3	0	0	20-over	10	13

A percentage table shows very little variation in age groups for these two areas. There were 3.5% more husbands and 2.2% more wives 40 years of age and over and 0.3% more children 10 years of age and over from the Brown Loam area. This slight difference hardly accounts for the larger families in the Brown Loam area.

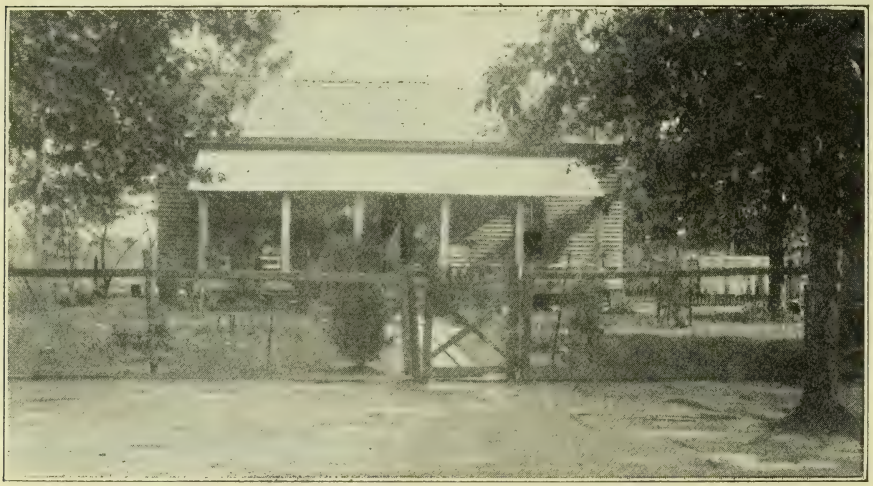


Fig. 2—A Busy Housewife of Rural Mississippi Finds Time to Cultivate Flowers and Trees.

Table 3—Financial Status of Families

Area	No. of records and occupation	Av'ge gross income	Av'ge No. of acres owned (l'owners)	Average value of real estate (l'owners)	No. of owners	No. of non-owners
Brown Loam	44 farmers 9 farm as sideline	$1,808.00	207	$4,556.00	37	16
Short Leaf Pine	45 farmers 2 farm as sideline	$1,195.00	133	$2,629.00	40	7
Both Areas	100 families	$1,519.89	172.22	$3,650.31	77	23

About 85% of the Short Leaf Pine families were landowners while only

70% of the Brown Loam families owned their farms. The Brown Loam families owned larger farms with a resulting higher gross income.

The financial status of the Brown Loam families was thus somewhat higher than that of the Short Leaf Pine families.

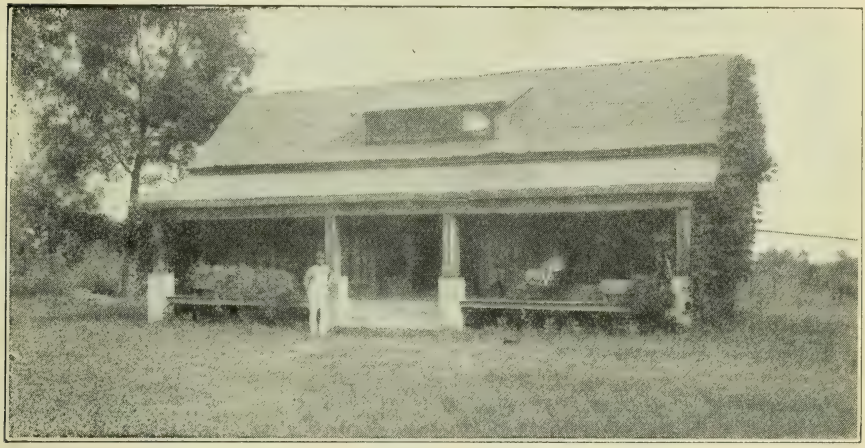


Fig. 3—One of the Most Comfortable Homes to be Found in these Areas. Notice the well constructed roof, the concrete steps and pillows, and the home-like touches

GENERAL FOOD FACTS

Methods of Cooking Used.

The housewife was not asked to keep a record of menus served. Such a record usually serves two purposes: (1) as a check on accuracy of the food record; (2) as a means of obtaining a better idea of combination of foods made than a list of amounts used over a period of time could give.

That the department employed women well acquainted with home conditions of each family, and that these women took both of the inventories and paid daily calls on each family, was considered as good a check on accuracy as was needed.

In order to get a better idea of combination of foods made than a list of food supplies used could give, information was obtained from each house-wife as to the usual method of serving some of the most common foods, such as meat, eggs, fruit, and vegetables. 61% of the families served their eggs fried; 42% fruit in pies; 53% fruit fresh; 83% meat fried; and 95% cooked their vegetables with salt pork. With this data and with a list of amounts of the different foods used, fairly accurate conclusions can be drawn as to food combinations made.

Use of Condiments and Beverages.

The food records did not include those products without nutritive value, such as beverages and condiments. Coffee was used in 76% of the homes. It was used to a greater extent than any other beverage of this class. Although it was used in such a large proportion of the homes, it was used by surprisingly few people. The father was often the only member who drank coffee. Fifty-one children from these hundred homes drank coffee.

Tea was used in only 7% of the homes. Iced tea is very generally used by town people, especially in the summer months. Its use is negligible among rural people. Very few of the rural people purchase ice, as it is expensive and troublesome to bring home. The majority consider it a luxury, especially as its season comes in a time when money is scarce. The fact that milk is kept cool in an artesian well or a cistern means that milk consumption is fairly high even in the summer months.

Black pepper was the most generally used condiment. It was used regularly in 96% of the homes. Vinegar was used daily in 15% of the homes. The use of spices, mustard, and flavorings was negligible.

Food Dislikes.

Of all the food classes, there were more dislikes in the vegetable group than in any other. Twenty-one people disliked all kinds of vegetables except potatoes. Of the vegetables commonly used in Mississippi, cabbage and turnips were the ones most often disliked. Twenty-six people record disliking cabbages, while twenty-five record disliking turnips. These dislikes were probably formed, not because these vegetables are strongly flavored, but because these vegetables which the majority of these people had tasted were poorly prepared. Food dislikes occurred in all classes of foods with the exception of fruits. Among the many food dislikes are: for milk-8, for pork-8, for butter-4, for eggs-4, and for chicken-4.

Climate and Rainfall of 1926.

February, May, August, and November were chosen as typical months for keeping the food consumption records. The Brown Loam study was started four days ahead of that of the Short Leaf Pine. This is the approximate difference in progress of agriculture in the two sections.

Despite the circulation of private prophecies widely current in the public press of 1925, that 1926 "would be a year without a summer" the deviations from normal meteorological conditions in 1926 were not impressive, at least as affecting Mississippi. The mean annual temperature for the state, 64.5 degrees, was less than ½ degree in excess of normal.

February was excessively warm, and November was unusually cool. November was cooler than it had been since state wide records were first kept. Monthly precipitation exceeded normal in November and was generally deficient in February. August was unusually warm and wet. The temperature was normal; the precipitation slightly below normal for May.

What effect would such deviations from normal have on food consumption? Perhaps the lower consumption for February, the higher for November can be partly explained by these deviations. The wet August of 1926 meant better gardens than normal. It is then probable that food consumption during this favorable August of 1926 was slightly greater than it would have been during one of our usual dry August months.

METHODS

For Conducting Study.

The supervisor visited the housewife, placed a pair of hanging spring scales in her kitchen, and weighed all foods on hand, both solid and liquids.

The housewife was instructed to keep a daily record of additions made to the food supply for a period of two weeks. Two types of daily records were used, one to record foods brought in from the farm, another to record

foods purchased. On these daily blanks, provision was made for keeping a record of waste of edible food*; that is, food sold, given away, or fed to animals. Space was also provided for the number of meals served to people in the various age groups. These records were checked over daily by the supervisors. At the end of the study the supervisors took another inventory.

In figuring the records, 10% was deducted for plate scraps. This simplified method of record keeping and the splendid cooperation of the supervisors were probably the two greatest factors which kept such a large percent of the families in the study throughout the year. One supervisor said, "None of my families have found record keeping a burden; in fact, many have enjoyed it". This supervisor did not have even one family withdraw from the study.

For Calculating Nutritive Value.

The short cut method [13] was used for figuring nutritive value of the dietaries. The calcium value for molasses was changed from .20 to .08. This change was based on an average of 24 analyses of syrup collected from all points in Mississippi.

The long method based on Sherman's figures [29] was used in calculating the nutritive value of cooked foods, such as preserves, jellies, biscuits, custards, pies, etc., foods not provided for in the short cut method. These foods were cooked by methods generally used in Mississippi. The nutritive value per pound of cooked products was calculated. The long method was also used in calculating water-melon and canteloupe, two fruits used in large quantities in August; for there seemed to be discrepancies between the two methods.

Before deciding definitely on the method to be used a number of the records were calculated by both the long and the short cut methods. In no case was the difference found to be greater than 5%. Thus it was assumed that the short cut method with changes mentioned above could be used. This assumption was based on: (1) the little difference found in the two methods, (2) the fact that food consumption figures were not based on edible portions, (3) that the waste (plate scraps) was not weighed and analyzed.

A double scale [13] was used in estimating the food requirements of each family. In this scale provision is made for the relatively greater need for protein and minerals of the growing child.

The double scale used in this study is as follows:

	Age	For energy	For protein and mineral
Adult male	18--60	1.2 A. M. U.	1.1 A. M. U.
Adult male	over 60	1.0 A. M. U.	1.0 A. M. U.
Adult female	18--60	1.0 A. M. U.	.9 A. M. U.
Adult female	over 60	.7 A. M. U.	.7 A. M. U.
Boy	15--18	1.2 A. M. U.	1.6 A. M. U.
Girl	15--18	.9 A. M. U.	1.2 A. M. U.
Child	11--14	.9 A. M. U.	1.2 A. M. U.
Child	6--10	.7 A. M. U.	.9 A. M. U.
Child	under 6	.4 A. M. U.	.6 A. M. U.

The term, A. M. U., usually expressed as 1.0, refers to the nutritive requirement of a moderately active man weighing 150 pounds. Because of

*This is termed waste, not in the true sense, but in that it was edible food not eaten by the family.

the relatively greater activity of adults on the farm, the factor, 1.2, was used to express the energy need of the man; and instead of the usual factor, 0.8, for the woman, 1.0 was employed. The standard per man per day, or 1 A. M. U., was for Calories, 3000; Protein, 75 gms.; Phosphorus 1.3 gms.; Calcium, .69 gms.; Iron, .015 gms.

The average number of A. M. U. per family for the entire study was, for energy, 5.004, and for protein and mineral, 5.562. The persons included in this calculation differ somewhat from those included in the number per average family.

For Getting Physical Examinations.

Eighty-two percent of the examinations were made by one physician from the Mississippi Board of Health. She was highly trained and experienced in this type of work. She made examinations to members of the eighty original families and to two families who later enrolled. These examinations were made during the latter part of January, February, and the first part of March—a time when colds and sore throats are most common. The services of this physician could not be obtained for completing these examinations. Hence the local health officers were called on to finish them.

Four types of blanks were used:

(1) For Adults—(a) **Periodic Health Examinations Blanks** prepared by American Medical Association; (b) **Questionnaire Blank** containing questions pertaining to health conditions usually assumed to be somewhat related to diet.

(2) For Children from five to eighteen years—**Dr. W. N. Emerson's Physical Examination Blank.**

(3) For Pre-School Children—**Physical Examination of Infant and Pre-School Child,** issued by the Mississippi State Board of Health.

The Questionnaire type of blank was filled out by either the physician or the investigator. The following type was used:

QUESTIONNAIRE BLANK

1. History.

	Living		Dead			
Member	Age	Health	Age	Year of Death	How long Ill	Cause of Death
Father						
Mother						
Brothers No. Living No. Dead						
Sisters No. Living No. Dead						

II. Previous diseases (with dates)

Appendicitis	Asthma
Apoplexy	Blood Spitting

Cancer or Tumor	Heart Disease
Carbuncles	Kidney Disease
Chronic Indigestion	Kidney Stones
Diabetes	Paralysis
Dysentery	Pleurisy
Dyspepsia	Pellagra
Gallstone	Rheumatism
Gastric or Duo Ulcer	Tonsilitis

Give other diseases requiring a physican or surgeon.

III. If a Woman Answers

(a) Number of children born
(b) Number of children living
(c) Number of children dead
(d) Cause of death
(e) Age at which each child died

IV. General Health Habits.

(Underline each word describing condition)

(a) General health—good——fair——poor
(b) Frequent colds
(c) Repeated indigestion
  (1) Excessive gas in stomach or intestines
  (2) Heart burn
  (3) Diarrhea
(d) Daily bowel movement
(e) Laxatives often used
(f) Frequent headaches
(g) Appetite—good——poor
(h) Rheumatism

V. Teeth.

(Underline word describing condition or fill in with number when necessary)

(a) Discolored
(b) Irregular
(c) Missing teeth_____ How many_____
(d) No. decayed_____
(e) No. filled_____
(f) Suffer from toothache
(g) Gums frequently bleed—irritated—pyorrhea

VI. Weight and Height.

_____pounds _____inches
overweight_____ underweight_____

VII. General condition of

(Underline word describing condition)

(a) Muscles—firm or flabby
(b) Skin—smooth, rough, clear, scars, swelling, pallor, redness.
(c) Eyes—circles——no circles
(d) Posture—erect——fatigue

VIII. Disposition

(Underline word describing condition)

(a) Vigorous, listless
(b) Cheerful, pessimistic
(c) Nervous, easy going

IX. Remarks:—

Fig. 4—Questionnaire Blank Used for Those People Not Desiring a Physical Examination.

The three types of blanks used for the examination included the usual points with a few additional ones in examination of children, such as:—(1) evidence of rickets, (2) condition of gums, (3) condition of the following glands—bronchial glands (D'Espine sign), supraclavicular glands, thyroid glands, glands at hilum, and mammary glands.

No blood, urine, or X-ray tests were made.

For Obtaining Sickness and Growth Records.

Illness records were kept by the housewife for each member of the family during the year of the study. They included: (1) nature of illness, (2) number of days ill, (3) doctor's visits, (4) cost of drugs, (5) visits to dentist.

Weight and height of children, and weight of adults were taken quarterly throughout the year. All weights and heights were taken by the supervisors. A schedule was worked out for weighing and measuring which made allowances for any delay which might occur in shipping the scales. The following tables were used for figuring correct weight for height:

(1) for adults, thirty and over—**Height and Weight Tables** from Fisher and Fish, "How to Live", page 214.

(2) For adults from eighteen to thirty—**Metropolitan Life Insurance Tables.**

(3) For children—**Thomas D. Wood's Tables.**

(4) For pre-school children—**Height Weight Tables** sent out by Bureau of Child Welfare Department of the Mississippi State Board of Health.

Height and weight were taken in house clothes without shoes. Underweight was calculated on the following basis: pre-school children 5% or more below standard; school children 10% or more below standard; adults 15% or more below standard; 20% or more above standard was counted as overweight for all groups.

For Valuing Food.

The housewife kept a record of the cost of all food purchased. Home raised products were priced at average retail selling price found in community stores where these families shopped. For those foods not offered for sale by these stores, the average selling price found in mail order catalogues was used. This method was used as it gave a good basis for comparison of the value of foods purchased with those furnished by the farm. The housewife was not asked to keep a record of those products ordinarily used containing no food value, such as salt, coffee, tea, soda, flavoring, etc. Thus the cost figures per man per day are probably a penny or so lower than is actually the case.

RESULTS

Food Consumption Studies.

Thirty-eight complete (by a complete record is meant a record of four seasons from one family) records were obtained from the Brown Loam area, and thirty-seven complete records from the Short Leaf Pine area. This makes a total of seventy-five records, or five less than was planned.

The amount of food consumption data which has been collected includes the seventy-five complete records and twenty-five incomplete records (records of from one to three studies). This means food records from one hundred Mississippi families.

Nutritive Value of Dietaries.

Table 4—Average nutritive value per man per day*.

Type of Record	Records	Energy	Protein	Calcium	Phosph's	Iron
	Number	Calories	Grams	Grams	Grams	Grams
Complete records Brown Loam area	38	3307	82.140	1.181	1.431	.0126
Complete records Short Leaf Pine area	37	3139	77.198	1.058	1.275	.0122
Complete records Both Areas	75	3223	79.198	1.119	1.353	.0124
Total records, 25 incomplete records included	100	3106	78.580	1.124	1.373	.0126

Table 5—Number of families** with dietaries 10% or more below standard in the different nutritive factors

No. Records		Calories		Protein		Calcium		Phosphorus		Iron	
Brown Loam	Short Leaf	Brown Loam	Short Leaf	Brown Loam	Short Leaf	Brown Loam	Short Leaf	Brown Loam	Short Leaf	Brown Loam	Short Leaf
38	37	4	6	4	8	1	2	6	12	24	23
Total 75		10		12		3		18		47	
Total expressed in Percent		13.33		16.00		4.00		24.00		62.66	

*Figured on unit basis.

**Families keeping complete records.

Dietaries from the Short Leaf Pine area were generally lower and more often deficient in one or more of the nutritive factors than those from the Brown Loam area. The number below standard in iron was the one exception to this statement.

How can this be accounted for? Money value of food consumed amounted to a little over four cents more per man per day for the Brown Loam Area. The housewife from the Brown Loam Area spent more in cash for purchasing food. In this way she could better supplement her food supply. The housewives from both areas used the little cash spent for food very wisely. Cereals, fresh fruit, meat, and cheese were the foods most commonly purchased.

The rural housewife could provide her family with balanced meals fur-

nished completely by the farm. As a general rule though, she uses little fore-sight in providing sufficient quantities of the different classes of food, and thus must supplement her menu by cash expenditure. It seems then that the explanation of better dietaries among the Brown Loam people was more money spent. It takes a great deal of intelligence, perhaps a $3,000 a year kind, to take a miscellaneous group of foods, and, with a very small amount of cash to supplement these foods and thus produce a balanced dietary.

Table 6—Frequency Distribution of Calories for the Two Areas

Energy groups	No. of cases from Brown Loam area	No. of cases from Short Leaf Pine area	Total No. of cases
Calories	Number	Number	Number
2000-2500	1	2	3
2500-3000	8	10	18
3000-3500	15	15	30
3500-4000	10	6	16
4000-4500	3	3	6
4500-5000	1	1	2

Table 7—Frequency Distribution of Protein for the Two Areas

Protein Groups	No. of Cases from Brown Loam area	No. of Cases from Short Leaf Pine area	Total No. of Cases
Grams	Number	Number	Number
50-60	1	2	3
60-70	5	8	13
70-80	10	11	21
80-90	9	7	16
90-100	8	5	13
100-110	3	2	5
110-120	2	2	4

Table 8—Frequency Distribution of Calcium for the Two Areas

Calcium Groups	No. of cases from Brown Loam area	No. of cases from Short Leaf Pine area	Total No. of Cases
Grams	Number	Number	Number
.3-.5	0	1	1
.5-.7	1	2	3
.7-.9	6	4	10
.9-1.1	8	10	18
1.1-1.3	10	11	21
1.3-1.5	6	6	12
1.5-1.7	4	0	4
1.7-1.9	3	3	6

Table 9—Frequency Distribution of Phosphorus for the Two Areas

Phosphorus Groups	No. of cases from Brown Loam area	No. of cases from Short Leaf Pine area	Total No. of cases
Grams	Number	Number	Number
.6-.8	0	1	1
.8-1.0	3	3	6
1.0-1.2	3	10	13
1.2-1.4	11	9	20
1.4-1.6	10	6	16
1.6-1.8	6	6	12
1.8-2.0	3	0	3
2.0-2.2	2	2	4

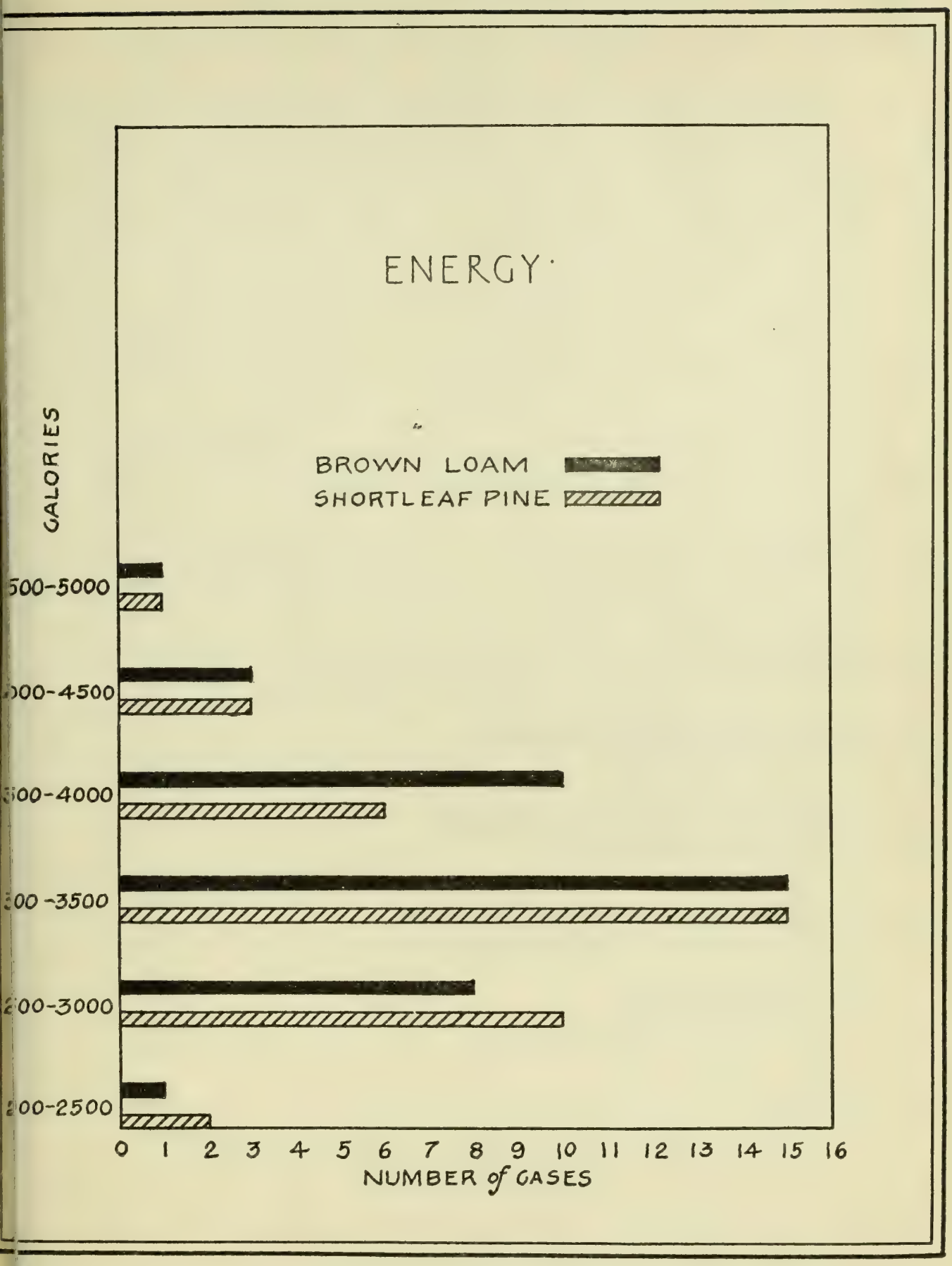


Fig. 5—Frequency distribution of calories in diets of families from the two areas.

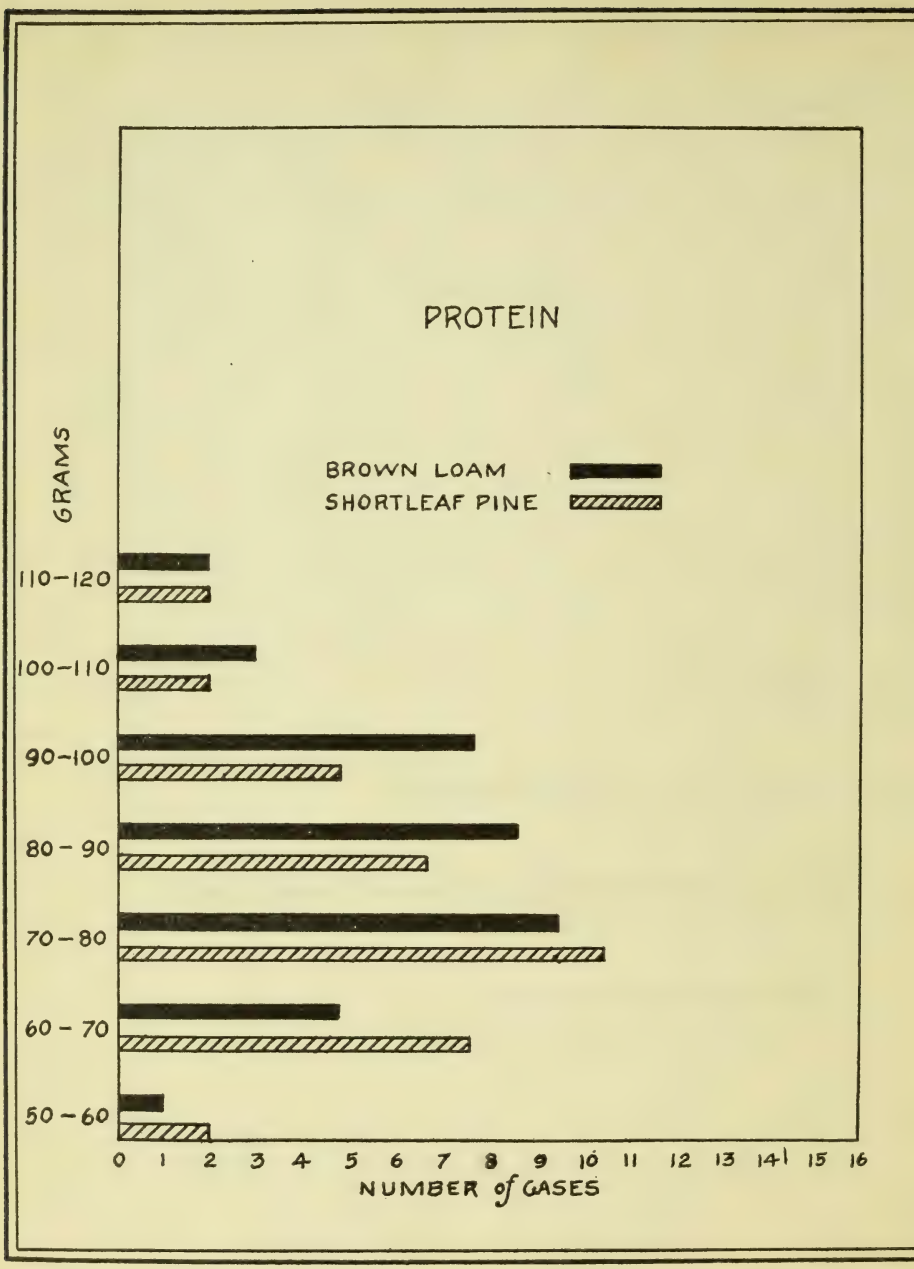


Fig. 6—Frequency distribution of protein in diets of families from the two areas.

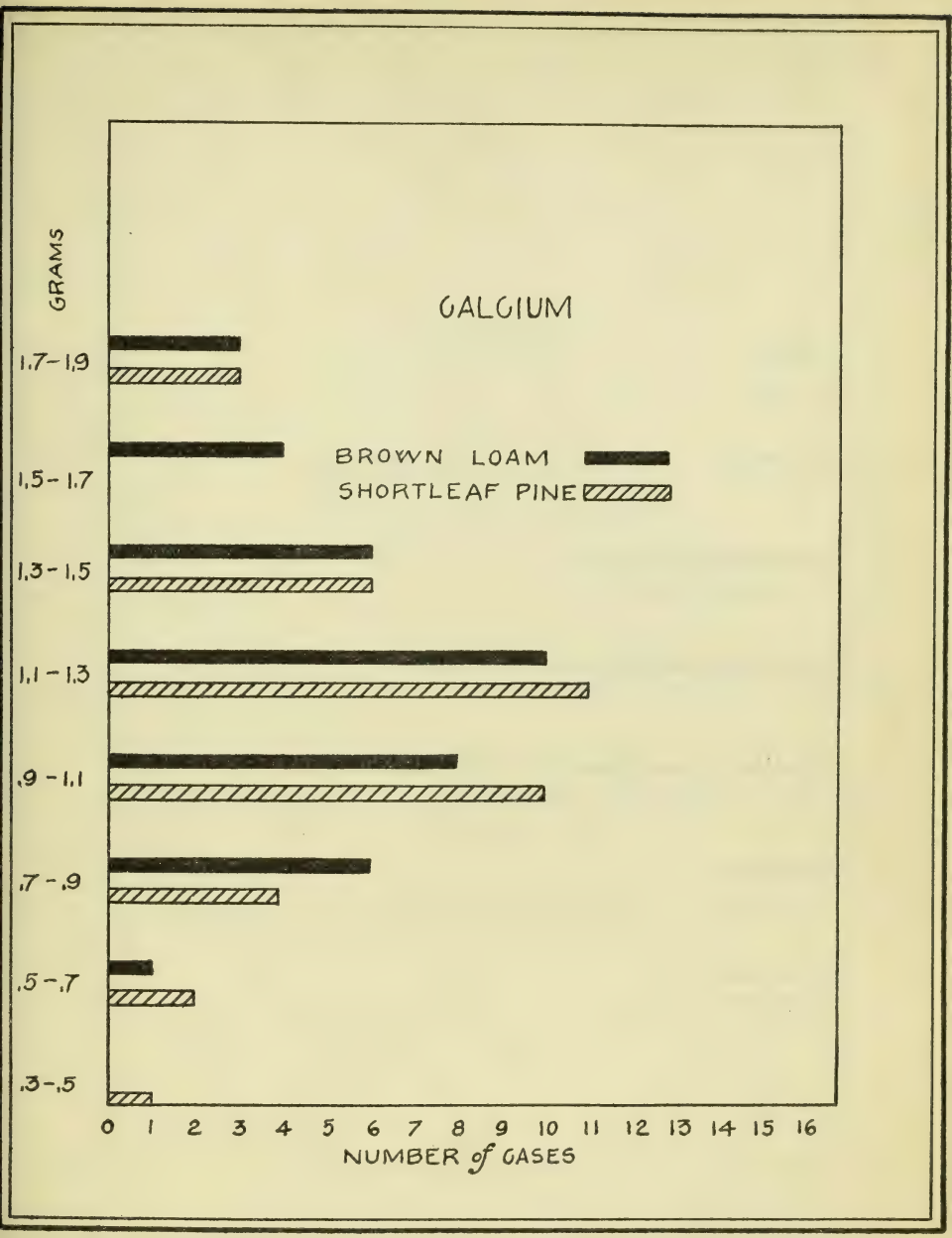


Fig. 7—Frequency distribution of calcium in diets of families from the two areas.

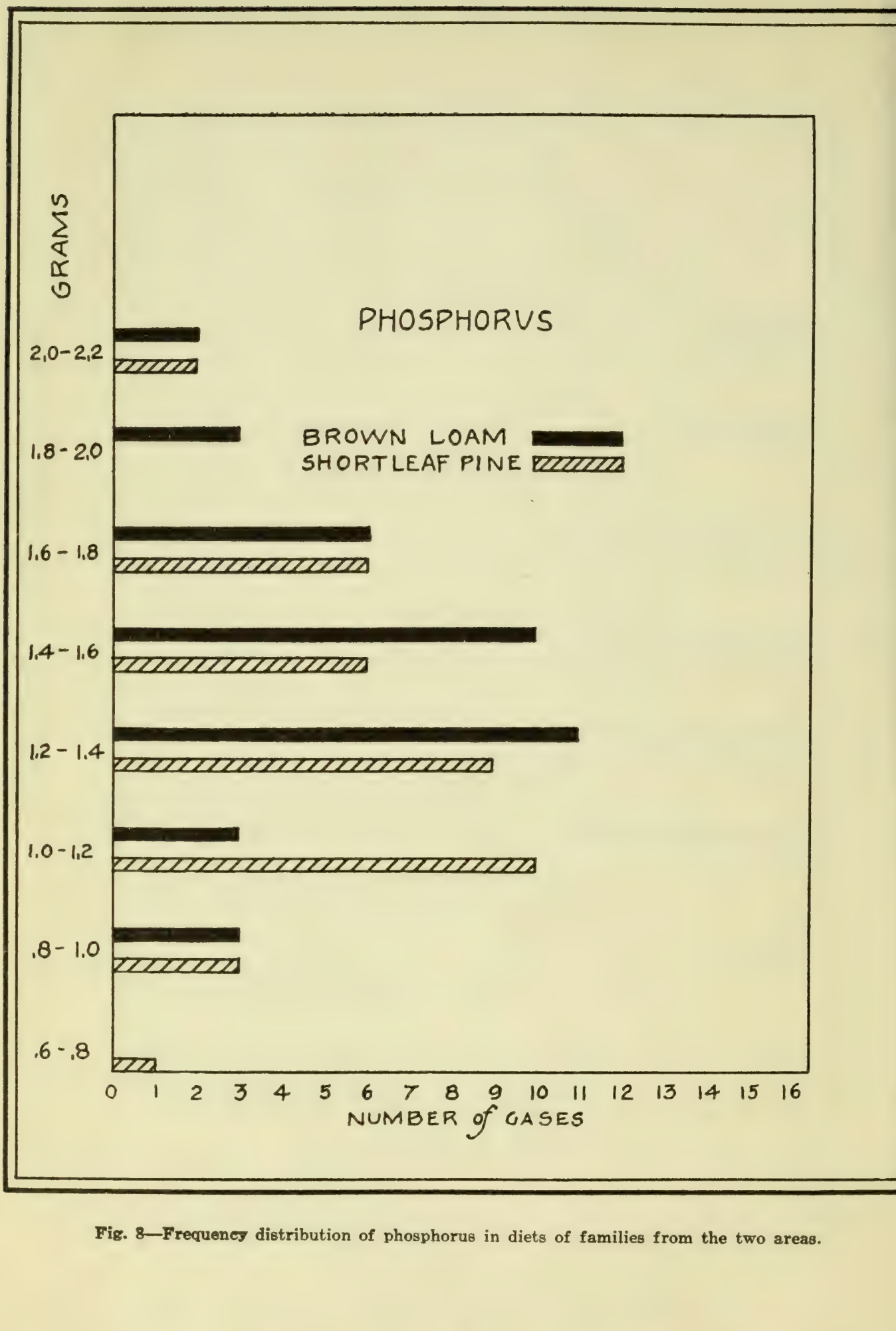


Fig. 8—Frequency distribution of phosphorus in diets of families from the two areas.

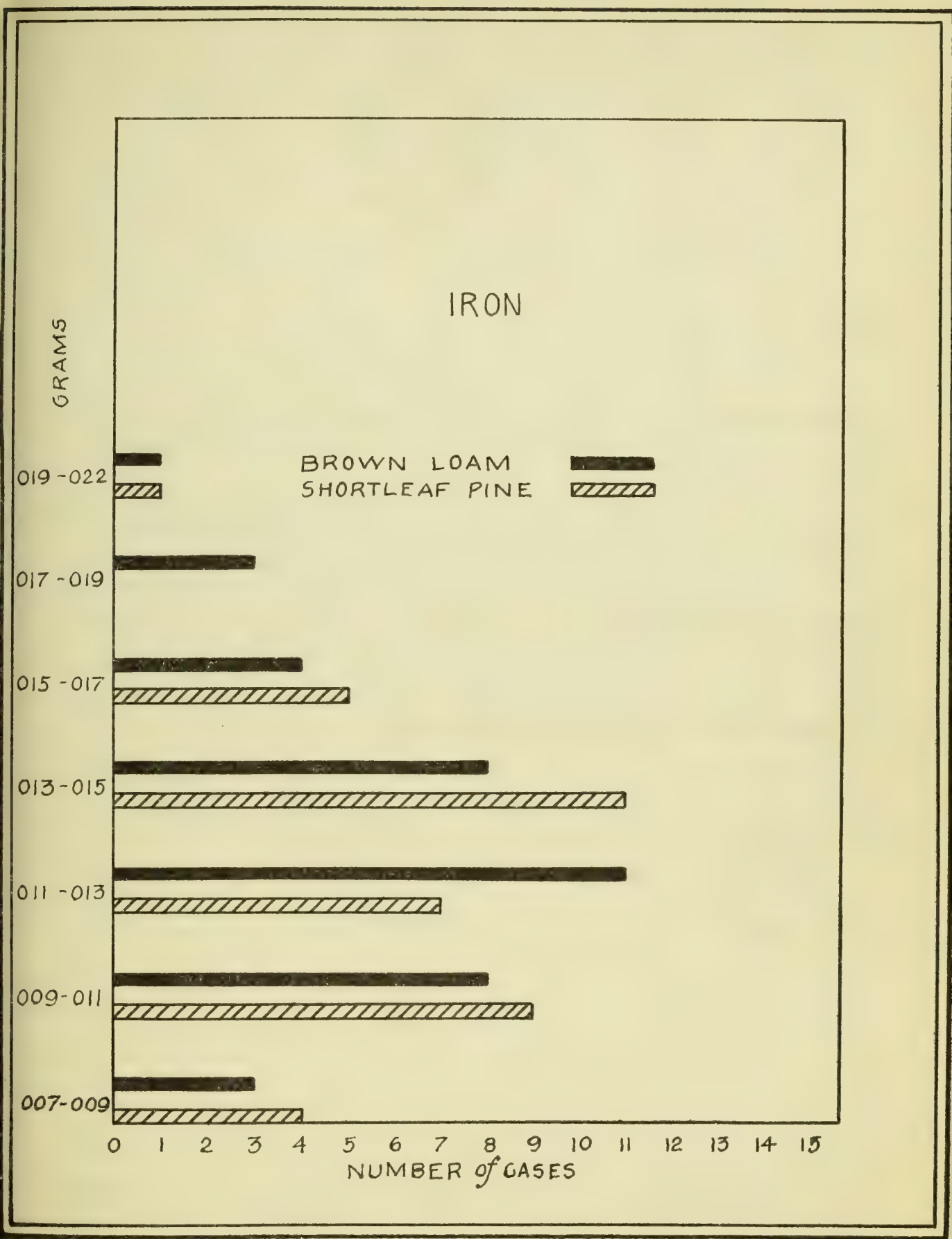


Fig. 9—Frequency distribution of iron in diets of families from the two areas.

Table 10—Frequency Distribution of Iron for the Two Areas

Iron Groups	No. of cases from Brown Loam area	No. of cases from Short Leaf Pine area	Total No. of Cases
Grams	Number	Number	Number
007-009	3	4	7
009-011	8	9	17
011-013	11	7	18
013-015	8	11	19
015-017	4	5	9
017-019	3	0	3
019-022	1	1	2

Comparison of Results with Standard Set by Sherman.

Dr. Sherman gives the following standard allowance to provide for the adult man's mineral needs; calcium .68 grams; phosphorus 1.32 grams; iron .015 grams. This corresponds with an allowance of 67 grams of protein. He has set the calcium and phosphorus requirement for the growing child at one gram.

The double scale, which was used in figuring the nutritive requirements of the family, provides practically the same allowance which Sherman has set for the adult. But this scale does not take into consideration the more recent standards of calcium and phosphorus for the growing child. Sherman gives no family allowance. In his recent edition, he states, "In our opinion, the food requirement of each member of the family should be determined on his own merit rather than in terms of the man's requirement." Hence, any comparisons of our figures, which are for the family, with Sherman's standard, which is for man, must be general.

Sherman states that from ten to fifteen percent of the total energy value of the diet should be furnished by protein. The average number of grams of protein furnished according to the complete records lacked .1% of furnishing Sherman's minimum allowance of 10%.

About one hundreth as much calcium as protein is another standard suggested by Sherman. The complete records average 79.198 grams of protein and 1.119 grams of calcium. This means that the calcium standard is more than met.

Average number in the family corresponds closely with the average number A. M.U. Then, it seems that even the more recent standard of one gram of calcium and phosphorus for growing children is met with such averages as 1.119 grams of calcium per man per day and 1.353 grams of phosphorus per man per day. An average iron consumption per man per day of .0124 grams meets Sherman's maintenance figure but not his standard figure.

Taking the averages as a whole, it will be seen that scarcely more than is actuallly necessary of calories, protein, phosphorus, and calcium is provided; and that iron is not provided in sufficient quantities.

In fact, the deficiency of iron in the dietaries of a number of families was such as to cause concern. The number of cases showing deficiencies in calories, protein, and phosphorus were less frequent. Using .69 grams of calcium per man per day as the standard, there were few cases showing

deficiencies. If Sherman's recent standard of a gram of calcium for growing children is taken into consideration, the number of dietaries showing calcium deficiencies would be somewhat increased.

Average Percentage Distribution of Nutrients in Dietaries.

Explanation of Food Groups

Food Groups								
1	2	3	4	5	6	7	8	9
Lard Butter Substitute	Bacon Salt Pork Sausage	Milk	Meat Fish Poultry Eggs	Miscellaneous As Cocoa Cheese Nuts Cream	Sweets	Fruits and Vegetables	Bread Cake Peanuts	Cereals

A record of the amount of milk brought in each day and the amount of whole milk, buttermilk, skim-milk, butter, and cream sold, given away, or fed to animals was kept. Group 3 therefore, contains milk products.

Waste of edible foods was taken from the group corresponding most closely, as cornbread and biscuit from group 9; vegetables, fruit pies, and soup from group 7; butter, cream, and buttermilk from group 3.

Table 11—Average Percentage Distribution of Nutrients Found in the 336 Records

Food Group	Calories	Protein	Calcium	Phosphorus	Iron
	Percent	Percent	Percent	Percent	Percent
1	11.1	*	*	*	*
2	7.4	3.6	.4	1.9	3.1
3	19.4	31.3	83.3	53.6	15.8
4	7.0	16.9	1.9	12.0	16.8
5	1.5	2.6	3.4	2.9	1.5
6	12.9	.3	3.6	2.4	17.4
7	7.2	7.3	6.0	10.2	21.8
8	1.8	1.9	.5	1.5	1.0
9**	31.7	36.1	.9	15.5	22.6

* Trace.

** Large quantities of cornbread made up with buttermilk, and often with eggs, were fed to animals.

As will be noticed later in this report, 94% of the families had milk cows, with an average slightly over two cows per family. Milk was used in generous quantities, furnishing more protein than any group except cereals. Principally because of this generous use, from 50% to 60% of the protein was derived from animal sources. Over 80% of the calcium and 50% of the phosphorus came from group 3. Although generally considered a poor source of iron, it is interesting to see that over 15% of the iron supply came from milk. None of the adults in the study showed a history of pellagra. This was probably due to the generous use of milk. It has been shown [11] that a daily supply of 40 fluid ounces of fresh buttermilk prevents pellagra.

Fig. 10—Such a Friend as This is Needed by Every Growing Boy.

The use of eggs in the diet was nearly as great as that of meat, fish, and poultry combined. Attention is called to the fact that the proportion of calories furnished by group 4 comes within the five to ten percent recommended by Rose for a very economical dietary, but below the 10%—15% for a dietary without cost restrictions. Studies of the value of meat at the Iowa Station have shown that addition of meats to a diet, provided enough vitamins and mineral salts are present, speeds up growth and reproduction and makes for optimum rearing of the young. Meat consumption in the average family was low; in fact salt pork was the only form of meat consumed by a number of families. As long as this was true, care should have been taken to provide right proportions of the other food groups. A limited meat supply without such provision was the cause of the iron deficiency.

It is interesting to note that the amount of baker's bread used per family per week did not average one pound, and that the amount of white flour averaged nearly fifteen pounds per family. Flour consumption was higher than cornmeal consumption. This was due to the fact that biscuits were usually served at breakfast and supper—cornbread at dinner. The percent of calories furnished by group 8 was less than it would have been in a similar study with city people.

The proportion of calories furnished by grain products was slightly less than that of *224 American dietaries. It came within the thirty to forty percent recommended by Rose for low cost dietaries. The use of whole grain cereals is important in a dietary where more than one-fourth of the calories come from the cereal group. Yet—whole wheat flour was used in only two records and in those records in small quantities. Less than one-half pound of oatmeal per family per week was used. In fact, refined cereals were practically the only ones used.

Only 7.2% of the calories came from the fruit and vegetable group, just about half of the proportion suggested by Rose for low cost dietaries. Herein lies an explanation for 63% of the dietaries being 10% or more below standard in iron.

The proportion of calories furnished by group 6 is higher than that of 224 American dietaries but within the limits set by Rose for low cost

*Page 555—[29].

Fig. 11—A Typical Rural Garden During the Month of September.
The butter beans and peppers are still bearing in spite of the weeds, drought and bugs.

dietaries. The proportion of iron furnished by this group was large. This was due to the fact that cane syrup was used in generous quantities by practically all families enrolled.

In this study, groups 9 and 3 furnished the greatest proportion of the calories, whereas in studies conducted by the United States Department of Agriculture and by the New York Association for Improving the Condition of the Poor, groups 9 and 4 furnished the greatest proportion of the calories. This difference is of course due to the fact that the Mississippi dietaries were built around milk—these other dietaries around meat. The average protein content for the Mississippi studies was 78.53 grams—for the 224 studies referred to above, 106 grams. This corresponds with the findings of dietary studies conducted in New Orleans [2]—that protein intake is lower in the South. Many have visualized our people as dining on chicken and corn pone. Such impressions are entirely false, at least, as far as these two areas are concerned.

There was very little difference in the average percentage distribution of nutrients in dietaries from the two areas. In fact, in no case was the difference as great as four percent. The proportion of nutrients obtained from group 7 was slightly less for the Brown Loam area, the trucking section. These differences are really too small to warrant discussion.

Discussion of Vitamin Content of Dietaries.

The human body requires more than protein, fats, carbohydrates, and mineral elements. A generous supply of vitamins is essential as well. Within the next fifteen or twenty years quantitative figures on vitamin content of food stuffs will probably be made available. Checking a dietary for its vitamin C content will perhaps be as common as checking a dietary for its calcium content. At the present time it is possible to draw only a few general conclusions as to vitamin content in a dietary.

The vitamin A and B requirements were probably met in the majority of these dietaries. A diet which furnished approximately .8* quart of milk and .8 of an egg per man per day, provides a large part of these requirements. Especially is this true in respect to vitamin A. Large quantities

*Figured on calcium basis.

of buttermilk were fed to animals. Very little butter was sold. Thus group 3 provided generous quantities of this vitamin. Vegetables and fruits, though used in insufficient quantities, probably rounded off the vitamin A and B supply. This of course applies to the majority of dietaries. There were perhaps a number of our housewives who failed to provide sufficient quantities of these two vitamins.

To protect from scurvy, one must have at least one pint of milk; or an ounce of orange juice or lemon juice or canned tomato or raw cabbage or raw onion; or about one pound of cooked cabbage or potato. This is only a fraction of the amount really needed for full health and vigor. Therefore, an equivalent of several of these should be provided in each day's food.

The majority of families had a good supply of vitamin C during the summer when watermelon, cantaloupe, and peaches were in season, when milk was so rich in vitamin C, and when tomatoes were used so generously. As the use of foods rich in vitamin C was rather limited during the fall, winter, and early spring months, it seems probable that the average dietary was low in vitamin C at this time. Collards, turnip greens, and cabbage were used throughout these months, but the method of cooking used, that of boiling uncovered for several hours with salt pork or lard, probably destroyed the vitamin. Onions and lettuce were the only raw vegetables used during these months. These were used in such small quantities that they could not be depended on as a source for vitamin C. Very little raw fruit was used except during the summer months.

What is the probable effect of such a deficiency? It has been shown [32] that a deficiency of vitamin C in the diet lowers the resistance to infectious diseases. Over one-fourth of the adults and one-half of the children had infectious diseases during the year of 1926. It was possible that a few of these cases were due to a shortage of this vitamin.

Many authors attribute the prevalence of tooth decay to the use of foods poor in vitamin C. Perhaps the fact that nearly fifty percent of both adults and children had one or more decayed teeth is due, at least in part, to diets low in vitamin C. Of course, this is suggestive only, for the vitamin content of a diet cannot be stated in quantitative terms. A disease or a physical defect can usually be attributed to more than one cause.

The antirachitic vitamin—vitamin—D is one of the factors sufficient to turn the scale between rickets and a normal development of the bone. This vitamin is present in egg yolks, whole milk, butter and green vegetables, the majority of these being fairly well provided in a large number of the dietaries. 24% of the complete records were low in phosphorus. This was due to type of cereals used and the relatively low proportion of calories furnished by Groups 4 and 7. The low phosphorus diets along with insufficient quantities of vitamin D or sunshine probably accounts for some of the rickets found among the children of the families selected.

In McCollum's recent edition of **"Newer Knowledge of Nutrition"** he gives two diets which Ferguson believes to be typical of what she termed rachitic and nonrachitic families in Glasgow. With such an idea in mind, records from two families living in the same community, with the same number of children, and having about the same financial standing, were selected.

A Two Weeks Food Supply During the Month of February*

	I. **Of a family in which three children out of four showed evidence of rickets	II. Of a family with four children — None showing evidence of rickets
Food	Pounds	Pounds
Lard	3.81	5.00
Butter	6.5	
Sausage	8.0	3.00
Salt Pork	18.5	5.1
Whole Milk		249.1
Skim Milk	16.25	
Butter Milk		1.5
Eggs	.13	1.75
Chicken	3.0	
Pork	6.00	6.00
Cocoa	.13	
Pecans		3.8
Sugar	7.38	10.00
Pear Preserves	2.8	
Molasses	15.25	13.00
Honey		3.00
C. Tomatoes	4.38	2.00
Greens	2.25	2.00
Turnips	5.25	3.00
Sweet Potatoes		12.25
Irish Potatoes		23.00
C. String Beans	4.00	
Mustard Greens		3.00
Collards		6.00
Onions		6.00
Kraut	3.00	
D. Peas	2.00	5.00
C. Peaches	1.63	7.25
C. Blackberries	2.19	
C. Plums		10.00
D. Apples		6.5
Beet Pickle	1.69	
Cucumber Pickle	1.44	
Mixed Pickle	4.25	
Flour	42.00	47.00
Meal	20.00	30.50
Rice		5.80

* A. M. U. for energy 1.108; for protein and mineral .76 greater for family No. II.
** This family in dairy business kept record of milk and products used instead of amount brought in.

This list does not take into consideration "Waste of Edible Food."

Not all families having one or more cases of rickets had such poor diets. In fact, rickets were found in a few families on excellent diets.

The varying amounts of sunshine received by the pre-school children would be a very important factor in modifying the ill effects of an inadequate diet. Housing conditions, as far as the amount of available sunshine is concerned, were adequate. The actual amount of fresh air and direct sunlight that the younger children received would depend upon the amount of time spent out of doors and upon house ventilation.

Nutritive Value of Edible Food Wasted.

Edible food fed to animals included, for the most part, milk, bread, and

vegetables. Waste (not including food sold) from a hundred families in one day was enough to meet the daily requirements for: calories—34 men; protein—61 men; calcium—263 men; phosphorus—124 men; iron—29 men.

The records of waste of edible food were higher for May and August. About twice as much iron was wasted in August as in any other month. Of all classes of foods, milk was the one most frequently recorded in space allowed for waste.

A housewife is never justified in feeding foods to animals which are needed by her children. In very few cases was a housewife in this study justified in selling eggs or in feeding edible vegetables to the chickens. Such foods were needed in the majority of homes to help furnish the iron requirements, in many homes to help furnish the protein requirements.

Seasonal Variations.

Table 12—Seasonal Variations

Found in 75 complete records expressed in percent below or above average.

Month	Calories	Protein	Calcium	Phosphorus	Iron
	percent	percent	percent	percent	percent
November	.25*	.15-	2.6*	2.45*	2.4*
May	3.7*	7.05*	9.45*	6.8*	1.8*
February	.5-	2.4-	8.7-	3.95-	.6*
August	3.45-	4.5-	3.35-	5.3-	4.8-
Variation	7.15	11.55	18.15	12.1	7.2

*Plus sign.

There is evidently some seasonable variation in the nutritive value of the Mississippi dietary. In May or late spring, food consumption was slightly higher than average, while in August, one of the warmest months of the year, it was lower. The high May record was due to increased milk consumption. April, May, and June are high milk production months. Milk consumption and production do not always thus run parallel. As far as production was concerned, August came next to May. As large quantities of both butter milk and skim milk were fed to animals or sold; milk consumption in August came below that of November, a low month as far as production is concerned. The hot August weather combined with poor facilities for keeping milk resulted in lowered consumption. Milk production was somewhat higher in November than February. The stock are usually turned into fields in the fall. By February, the old pastures and fields are pretty well gone over, and the new grass is not up. The quantity of milk produced was consequently higher for November. However, the variation in these two months cannot be entirely attributed to production. Nearly three times as much milk was sold in February as was sold in November.

In November, 9.4% of the calories and in May, 4.1% of the calories

Table 13—Average Percentage Distribution* of Calories in the Four Seasons

Month	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9
	percent	percent	percent	percent	percent	percent	percent	percent	percent
February	10.9	9.2	16.0	8.8	1.6	13.2	6.5	2.6	31.2
May	10.8	6.8	21.6	7.5	1.3	12.5	4.1	1.5	33.9
August	11.6	5.7	21.6	5.3	1.1	13.8	8.7	1.0	31.2
November	11.3	7.7	18.5	6.3	2.1	12.0	9.4	2.1	30.6
Average	11.1	7.4	19.4	7.0	1.5	12.9	7.2	1.8	31.7

*96 records for February, 80 records for the other three months.

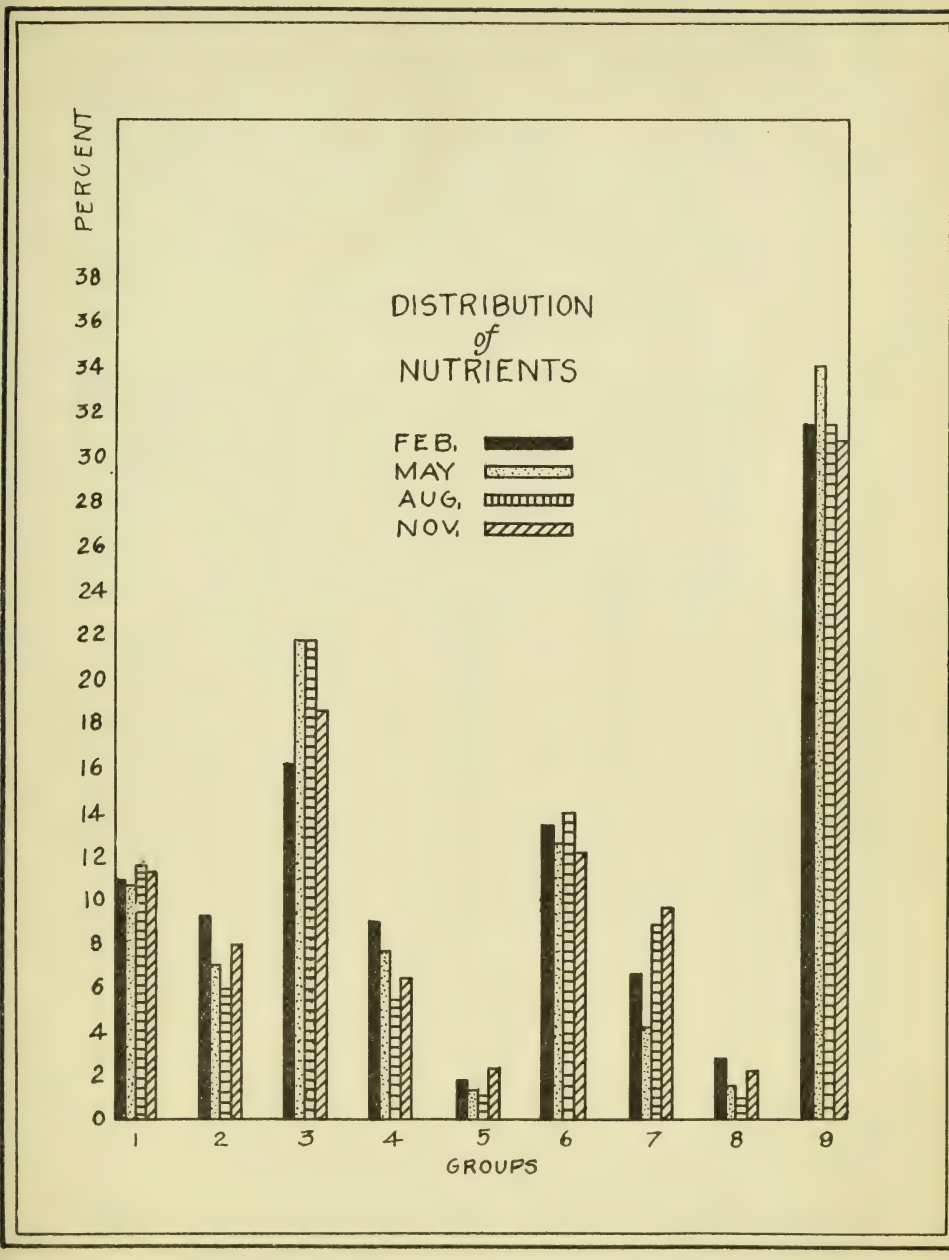


Fig. 12—Average percentage distribution of calories in the nine food groups for the four seasons.

were furnished by Group 7. This explains what seems to be a discrepancy in variation of iron for November and May.

There was little seasonal variation in the nutritive values of the Mississippi dietary. What little variation was found was largely due to variation in milk consumption and in types of vegetables used.

Just as there is little variation in nutritive value of dietaries during the different seasons, so there is little variation in distribution of calories. Groups 3 and 7 were the only groups that showed as great variation as 5%. The greater percent of calories furnished by Group 7 for November was due to amount of sweet potatoes used.

Table 14—Average Number Pounds* of the Most Common Foods Used per Family** per Two Weeks

Food Item***	Month			
	February	May	August	November
	pounds	pounds	pounds	pounds
Flour	30.15	32.57	28.63	27.14
Rice	2.56	2.02	1.50	1.86
Oatmeal	.75	.21	.30	.55
Bread	2.81	1.35	1.67	1.86
Cornmeal	19.20	26.17	20.44	20.81
Sugar	10.20	10.43	11.66	8.36
Molasses	9.25	8.58	3.18	9.36
Jelly and Preserves	2.30	1.02	3.11	1.37
Lard	6.01	5.91	6.10	6.22
Salt Pork	5.26	4.70	3.67	4.46
Sausage	3.12	.38	.09	2.49
Pork	5.93	2.77	1.26	4.06
Beef	1.70	1.78	2.47	2.47
Poultry	1.74	1.75	6.77	2.70
Eggs	9.39	10.21	6.45	3.28
Cheese	.65	.26	.28	.79
Fresh Apples	3.42	1.00	5.24	3.42
Canned Apples	2.43	1.23	.28	1.18
Canned B. Berries	2.32	1.37	.21	1.08
Dry Peas	1.00	.43	.02	1.79
English Peas	.13	7.27		.04
Turnips and tops	8.15	8.92	.87	8.12
Canned Tomato	3.08	1.32	.26	4.28
Fresh Tomato			9.13	.75
Sweet Potato	13.62	.56	3.54	25.39
Irish Potato	3.16	4.22	4.62	3.50
Onions	.61	2.34	.56	.27
Cabbage	1.08	7.38	1.45	.53
Lettuce	.06	1.79	.01	.07
S. Beans	.21		4.01	1.01
Collards	1.72		.08	3.32
Canned Corn	.13	.03		.09
Okra			2.52	.02
Fresh limas			6.88	1.09
Pickle	.90	.38	.73	1.50

*This does not allow for edible food fed to animals.

**Average of 96 records for February, 80 records for the other three months.

***Figures for whole milk are production figures rather than consumption figures, and are, hence, not included in this table.

The amount of staple supplies used did not vary greatly from season to season. Great variation was found among the other foods, as milk, meats,

poultry, eggs, fruits, and vegetables. There was evidently a law of compensation in force, for in August there were string beans, tomatoes, butterbeans, and field peas; in May, cabbage, English peas, and turnip greens. If the season was a poor one for eggs, it was generally a good one for meat and poultry.

No seasonal variation should be found in nutritive value of dietaries from a climate such as Mississippi has. As far as fruits and vegetables are concerned, it seems more a question of utilizing them to the fullest at each season, than it does of preparing for times of scarcity in seasons of plenty. There are, or should be, no seasons of scarcity in Mississippi.

Marked seasonal variation was found in neither area. The little variations found run along so parallel that it was thought unnecessary to show them for both areas.

Effect of Home Raised Products on Nutritive Value of Diet.

Does a quantity of home raised products necessarily guarantee an adequate consumption of these products? It has often been said that it was no guarantee. Yet if a farmer's wife is asked what her family eats, she generally replies, "Simple food which is raised on the farm". Just what is the relation of consumption to production?

Table 15—Average Calcium Content* in Diets of Families with No Milk Cows, One Milk Cow, Two Milk Cows, and More than Two Milk Cows

Milk Cows	Total Cases	Calcium per man per day
Number	percent	grams
0	6	.665
1	29	1.131
2	30	1.167
More than 2	35	1.132

Table 16—Average iron content* in diets of families with no garden, with no fruit trees, preserving less than five gallons of food each year, and having less than one dozen hens, compared with iron content in diets of families well provided with these.

Item	Those Having Items Named		Those Not Having Items Named	
	Total cases	Iron per man per day	Total cases	Iron per man per day
	percent	grams	percent	grams
Garden	92	.0130	8	.0106
Fruit trees	83	.0128	17	.0126
Food preserved	92	.0129	8	.0109
Hens	94	.0129	6	.0107

*Figured on the family basis.

There is evidently a close relation between consumption and production. That is, if the farm does not provide milk, if the farm does not provide vegetables, if the farm does not provide poultry, then not as many of these foods will be used.

Two cows seem to be the best provision as far as the calcium content is concerned. This does not mean pure-bred cows but the average Mississippi cow. The majority of families owning more than two cows sold milk products. Consequently their calcium content was no higher than those owning only one cow. Greater variation existed in calcium content of

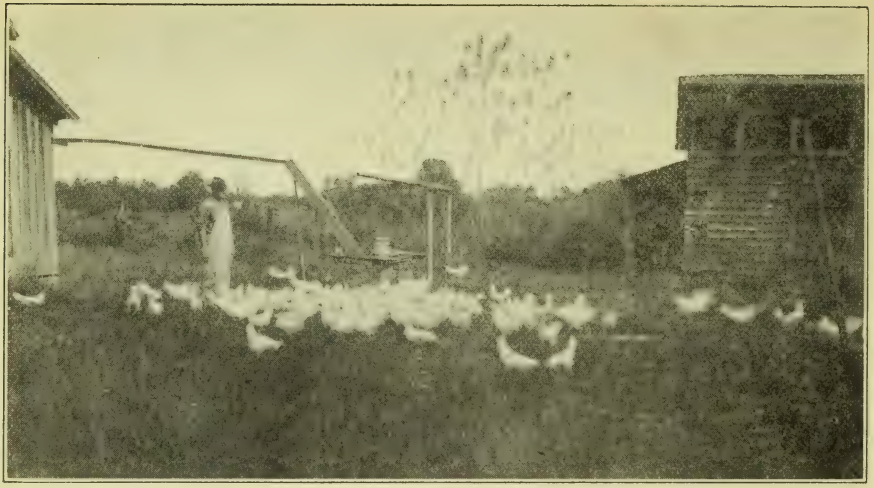


Fig. 13—This Flock Produces Plenty of Eggs for Family Use as well as a Liberal Surplus for Sale.

dietaries in the "more than two cow" group than in any other group. A plentiful milk supply was a means of raising cash for some, for others an opportunity for plentiful consumption.

Just what effect does a yearly income of fifty dollars or more from the sale of milk or products, vegetables, fruits, poultry or products have on nutritive value of dietary? The nutritive value of dietaries of the 29 families* coming in such a group was as follows:—calories 3239; protein 82.69; calcium 1.128; phosphorus 1.390; iron .01254. This average corresponds closely with average figures for the entire study. That is, these people belong neither to the low or high group as far as consumption is concerned.

It is evident that families raising and selling large quantities of food products consume more than do families who neither raise nor sell to any extent. The extension person who says, "Teach them to produce for sale, and consumption will result" —has evidently good ground on which to base the statement.

On the other hand, highest consumption is not always from families with highest production. In fact, highest consumption seems to be from the group raising generous amounts, but amounts not large enough to warrant seeking a market for.

Probable Food Combinations.

All the talk of "eat more of this or eat more of that" is of no avail unless you can get it eaten. An adequate food supply does not always guarantee adequate consumption. Skill in combining as well as in preparing food plays a large part in getting food eaten. As stated before, the housewife was not asked to keep a record of menus served. It was thought that a good idea of food combinations used could be obtained from the food consumption and cookery records.

*Figured on family basis.

Such data combined with a knowledge of home conditions of the families enrolled made it possible to approximate menus served. With such an idea in mind the November records from two families were selected. One contained little variety, the other as great variety as found in any of the records.

A Week's Menus from a Family* Whose Food Supply Contained Little Variety.

Breakfast	Dinner	Supper
MONDAY		
Fried Salt Pork	Collards	Warmed-over Collards
Biscuit	Baked Sweet Potatoes	Warmed-over S. Potatoes
Butter	Cornbread	Biscuit
Molasses	Biscuit	Butter
Milk	Butter	Molasses
	Molasses	Milk
	Milk	
TUESDAY		
Batter Cakes	Baked Sweet Potatoes	Fried Sweet Potatoes
Rice and Gravy	Cornbread	Biscuit
Butter	Butter	Butter
Molasses	Custard Pie	Molasses
Milk	Milk	Custard Pie
		Milk
WEDNESDAY		
Fried S. Potatoes	Collards	Fried Salt Pork
Biscuit	Sweet Potatoes	Warmed-over Collards
Butter	Cornbread	Biscuit
Molasses	Biscuit	Butter
Milk	Butter	Molasses
	Molasses	Milk
	Milk	
THURSDAY		
Fried Salt Pork	Baked Sweet Potatoes	Rice and Gravy
Biscuit	Cornbread	Biscuit
Butter	Biscuit	Butter
Molasses	Butter	Fig Preserves
Milk	Molasses	Milk
	Milk	
FRIDAY		
Fried Sweet Potatoes	Collards	Salmon**
Biscuit	Cornbread	Fried S. Potatoes
Butter	Biscuit	Biscuit
Molasses	Butter	Butter
Milk	Sweet Potato Pie	Molasses
	Milk	
SATURDAY		
Rice and Gravy	Baked Sweet Potatoes	Fried Salt Pork
Biscuit	Cornbread	Rice and Gravy
Butter	Biscuit	Biscuit
Molasses	Butter	Butter
Milk	Molasses	Molasses
	Milk	Milk

*This family did not use coffee.

**The majority of rural people avoid the fish and milk combination.

SUNDAY

Breakfast	Dinner	Supper
Fried Salt Pork	Chicken	Chicken
Biscuit	Dressing	Dressing
Butter	Rice	Rice
Molasses	Gravy	Gravy
Milk	Canned Tomatoes	Biscuit
	Biscuit	Butter
	Butter	Sweet Potato Pie
	Sweet Potato Pie	Milk
	Milk	

A Week's Menus from a Family whose Food Supply contained a Good Variety of Food

MONDAY

Breakfast	Dinner	Supper
Fried Eggs	Pork Roast	Spaghetti with Tomato Sauce
Flour Muffins	Baked S. Potatoes	Fried S. Potatoes
Butter	Boiled Cabbage	Biscuit
Molasses	Cornbread	Butter
Coffee and Milk	Butter	Fig Preserves
	Custard Pie	Milk

TUESDAY

Sausage	Vegetable Soup	Vegetable Soup
Batter Cakes	Fried S. Potatoes	Crackers
Biscuit	Mixed Pickle	Peanut Butter Sandwiches
Butter	Cornbread	Biscuit
Molasses	Butter	Butter
Coffee and Milk	Cake and Sauce	Molasses
		Milk

WEDNESDAY

Sausage	Fried Steak with Onions	Bacon
Fried S. Potatoes	Tomato Gravy	Grits
Biscuit	Baked Sweet Potatoes	Gravy
Butter	Biscuit	Mixed Pickle
Molasses	Butter	Biscuit
Coffee and Milk	Custard Pie	Butter
		Molasses
		Milk

THURSDAY

Bananas	Vegetable Soup	Fried Eggs
Toast	Crackers	Corn Muffins
Biscuit	Mashed I. Potatoes	Biscuit
Butter	Cornbread	Butter
Molasses	Butter	Molasses
Coffee and Milk	S. Potato Pie	Bananas
		Milk

FRIDAY

Bacon	Turnip Greens	Fried Eggs
Fried S. Potatoes	Mashed I. Potatoes	Rice and Gravy
Biscuit	Spaghetti with Tomatoes	Corn Muffins
Butter	Biscuit	Biscuit
Molasses	Butter	Butter
Coffee and Milk	Fig Preserves	Fig Preserves
		Milk

SATURDAY		
Breakfast	**Dinner**	**Supper**
Bacon	Salmon Croquettes	Fried S. Potatoes
Rice and Gravy	Fried I. Potatoes	Scrambled Eggs
Biscuit	Cucumber Pickle	Butter
Butter	Biscuit	Biscuit
Molasses	Butter	Oranges*
Coffee and Milk	Fig Preserves	Milk
SUNDAY		
Oranges	Chicken	Chicken
Fried Eggs	Dressing	Dressing
Toasted Biscuit	Rice	Rice
Batter Cakes	Gravy	Gravy
Butter	Mixed Pickle	Irish Potato Salad
Molasses	Candied S. Potatoes	Biscuit
Coffee and Milk	Irish Potato Salad	Butter
	Lemon Pie	Milk

*Family would probably eat these in afternoon instead of for supper.

It is improbable that these two housewives showed this much ingenuity in swapping foods about. For instance, collards were probably used for three successive days instead of Monday, Wednesday and Friday.

The average Mississippi housewife is more apt to spend her time or money on a cake or pie than she is on a salad. In fact, potato salad is about the only salad in general use among our rural people.

That the rural housewife of Mississippi should provide her family with greater variety, that she should make better use of the food she has on hand, cannot be doubted. That she has made great strides in this direction within the last few years is a fact not to be forgotten.

Physical Condition of Members of One Hundred Families Enrolled in the Project.

The data to be tabulated and discussed under this heading includes:—the physical examination, conditions indicating general health, and the illness records of 1926.

Under the heading of physical examination, the percent of the total having certain physical defects is listed. For example, under skin, abnormalities such as roughness, scars, tetter, and boils are included; under ear,

Fig. 14—A Health as Well as a Financial Asset.

Table 17—Frequency of Physical Defects among Adults-o- and Children

Impairment	Adults		Children		
	Brown Loam records (1)	Short Leaf records (2)	Brown Loam records (3)	Short Leaf records (4)	Of Total Defects
	percent	percent	percent	percent	percent
Lines under eyes'	29.7	36.4	24.7	31.0	4.10
Flabby Muscles'	19.0	22.0	18.2	27.9	3.40
Fatigue Posture'	25.1	39.8	24.1	31.7	4.10
Bosses Prominent			1.2	.8	.10
Eye or Eyelids	29.6	30.1	29.4''	24.0''	3.90
Pale Mucous Membranes	25.9'	27.1'	16.5	25.8	2.90
Decayed Teeth'	38.1	45.7	52.3	46.5	7.40
Poor Approximation			19.6	27.2	3.20
False Teeth'	28.2	16.1			
Gums	29.0'	38.1'	17.1	17.5	2.40
Skin	20.6'	22.0'	14.1	16.6	2.10
Nose	25.9	22.2	47.8	46.2	6.70
Throat	33.3	38.0	41.1	51.2	6.40
Tonsil	29.6	30.1	57.6	67.7	8.80
Tongue			4.2	4.9	.60
Ant. C. Glands			57.6	58.7	8.20
Post C. Glands			49.0	56.1	7.40
Bronchial Gland (D'Espine sign)			2.3		.20
Supraclavicular Glands			6.1	4.9	.80
Thyroid Glands		3.1	.6	3.3	.20
Glands at Hilum			1.2		.10
Mammary Glands			.6		.04
Ear	25.9	23.8	20.8	13.2	2.50
Heart	33.3	28.5	14.7*	10.7*	1.90
Lung	7.4	4.7	6.7	7.4	1.00
Abdomen			7.9	8.2	1.10
Hernia			.6		.04
Pot Belly			1.8	1.6	.20
Curvature			14.7	3.3	1.40
Depression Lower End of Sternum			.6		.04
Round Shoulders			19.0	24.7	3.10
Prominent Inner End of Clavicle			.6		.04
One Shoulder Lower			3.6	.8	.40
Pigeon Chest			1.2		.10
Flat Chest			21.4	29.7	3.50
Barrel Chest			.6		.04
Funnel Chest			1.8	3.3	.40
Marked Depression in Chest				1.6	.10
Flaring Ribs			3.6	14.0	1.20
Beaded Ribs			.6	.8	.10
Flat Feet			11.0	17.3	2.00
Marked Evidence of Rickets			12.8	26.4	2.70
Underweight'	16.7	11.8	28.2	35.6	4.70
Overweight'	13.7	14.4	3.5	1.5	.40

-o-Spaces left blank indicate no examination for that point.

(1) 27 adult forms and 104 questionnaires.

(2) 63 adult forms and 55 questionnaires.

(3) 125 Emerson, 38 infant forms, and 7 questionnaires.
(4) 81 Emerson, 40 infant forms, and 8 questionnaires.
' Data from questionnaire blanks averaged in.
* Organic murmur diagnosed in three of the Brown Loam children and in two of the Short Leaf Pine children.
" Conjunctivitis diagnosed in three of the Short Leaf Pine children and one child from the Brown Loam area.

wax impaction as well as defective hearing; under eye or eyelid, poor vision, strabismus, conjunctivitis, granular lids, inflamed lids, nervous twitch to eye.

Conditions indicating general health were obtained by questioning members of the family. These were filled out at the time of the examination.

The third class of information was obtained from illness records kept by the housewife during the year of 1926. Only illnesses severe enough to require consulting a physician or sending a patient to bed were recorded.

Table 18—Number of Defects per Individual among the Children Examined.

Number of defects	170 Cases Brown Loam	129 cases Short Leaf
0	5	1
1	9	8
2	7	6
3	11	9
4	18	5
5	21	17
6	17	12
7	25	20
8	11	17
9	12	12
10	12	9
11	8	7
12	7	4
13	5	3
14	2	4
Total Number of Defects	1091	913

The mode, or the number occurring most frequently, is the same for both groups.

A greater number of defects were found among the children. This was probably due to two facts: (1) the questionnaire blank was filled out for over half the adults; (2) the children were more thoroughly examined.

Table 19—Average Number of Physical Defects at Various Ages.

Age	Brown Loam		Short Leaf Pine	
	% of Total Group	Average No. Phys. Defects	% of Total Group	Average No. Phys. Defects
	percent	number	percent	number
3 and under	14	5.29	20	6.11
4 - 6	17	6.62	20	7.28
7 - 9	21	7.16	16	8.33
10 - 12	21	6.83	15	8.31
*13 and over	27	5.93	29	6.28

*15 questionnaire blanks included in these averages.

The average number of defects was greater for both adults and children from the Short Leaf Pine area. This difference can be, at least, partly accounted for by two facts: (1) the living conditions as well as the diets of the Brown Loam people were somewhat better; (2) twelve families were examined by local health officers in the Brown Loam area and only six families in the Short Leaf Pine area. As doctors differ in standards of judging, a difference of six families might account for part of the difference found in the two areas.

The children represented all stages of the school and pre-school periods—but the largest number in each area were thirteen years of age and over. The above table indicates that the majority of physical defects were present in the pre-school period. There was very little variation in the number of defects at the various ages, though the 7-9 age group showed a slightly greater number.

Comparison with Results of Other Studies.

The results of these examinations cannot be very well compared with those of other studies; first, because of the difference in methods and standards used by physicians in making physical examinations, second, because of difference in methods of counting or grouping physical defects.

For instance, in this study flaring ribs and evidence of rickets were counted as two defects; in other studies they might be counted as one. Lines under the eyes, flabby muscles, fatigue posture, and underweight are often grouped under the general heading of poor nutrition. In this study they were counted as four defects.

The physical condition of these rural children of Mississippi, the majority

Table 20—Relative Frequency of Defects in Children from *16 Families on Satisfactory Diets

Arrayed on Average Number of Defects per Child per Family

Children in Family	Total defects per family	Average number defects per child						
		Total defects	Postural	Underweight	Tooth decay	Nasopharyngeal obstructions	Rickets	Other defects
number	number	number	number	number	number	number	number	number
1								
1								
1	1	1.00		1.00				
1	2	2.00		1.00	1.00			
2	5	2.50	1.50			.50	.50	
4	11	2.75			.50	1.25		1.00
5	15	3.00			.20	1.20		1.60
3	11	3.67		.67	.33	.67		2.00
4	19	4.75	.50	.25	.50	1.50	.25	1.75
1	5	5.00				3.00		2.00
2	11	5.50	1.00		.50	1.50		2.50
3	19	6.33	1.00	.67	.33	2.00		2.33
2	13	6.50	2.00	1.00	.50	1.00		2.00
2	13	6.50	1.00		.50	2.00		3.00
3	22	7.33	.67		.30	2.33		4.00
1	9	9.00	1.00			2.00	1.00	5.00
Average								
2.25	9.75	4.11	.54	.29	.29	1.18	.11	1.70

* Two Families included whose iron content averaged .0149 grams.

of whom were receiving satisfactory quantities of milk, should be, to say the least of it, much better than that of the average urban child.

Relation of Diet to Physical Condition.

The average number of defects per child per family, the average number of postural defects per child per family, of nasopharyngeal obstructions per child per family, cases of underweight per child per family, tooth decay and rickets per child per family, from families on satisfactory diets, on diets deficient in one factor, and on diets deficient in more than one factor, were grouped together. It was hoped that such a grouping would reveal some of the general relations that exist between diet and physical condition.

Satisfactory diets were those containing all nutritive factors in quantities standard or above. Diets below standard in one factor were without exception diets low in iron. Diets below standard in more than one factor included those below standard in from two to five nutritive factors. Only data from families keeping complete records were used in these comparisons.

Table 21—Relative Frequency of Defects in Children from 26 Families on Diets below Standard in One Factor

Arrayed on Average Number of Defects per Child per Family

Children in family	Total defects per family	Average number defects per Child						
		Total defects	Postural	Underweight	Tooth decay	Nasopharyngeal obstructions	Rickets	Other defects
2								
2	3	1.50	1.00		.50			
4	8	2.00		.25		.75		1.00
3	7	2.33		.67		.67		.99
4	10	2.50		.50	.25	.25		1.50
1	4	4.00			1.00			3.00
2	8	4.00		.50		1.00		2.50
2	9	4.50		1.00	.50	1.00		2.00
1	5	5.00				2.00		3.00
3	15	5.00	.67		.33	1.33		2.67
4	20	5.00	1.00	.25	.50	1.75		1.50
8	42	5.25	.75		.75	1.38		2.37
5	30	6.00	1.00	.20	.40	1.40	.20	2.80
1	7	7.00			1.00	2.00		4.00
1	7	7.00				3.00		4.00
5	37	7.40	.80	.40	.60	2.40		3.20
5	37	7.40	1.20	.20	.40	2.20	.20	3.20
4	30	7.50	1.00	.25	.50	1.75		4.00
2	15	7.50	2.00		.30	2.00		3.00
3	23	7.66	2.00	.33	.67	1.33	.33	3.00
1	8	8.00		1.00	1.00	1.00		5.00
4	32	8.00	.50	.25	.50	2.50		4.25
2	17	8.50	1.50	.50	.50	1.50	.50	4.00
3	27	9.00	1.00	1.00	.33	2.67		4.00
2	20	10.00	1.50		.50	3.00		5.00
3	31	10.33	2.33	.33	.67	3.00	.33	3.67
Average								
2.96	17.38	5.86	.70	.30	.44	1.53	.06	2.83

The number of physical defects among children increased as deficiencies in diets of their families increased. The most poorly nourished group was also the group with the largest families. Indeed, "families that have the

Table 22—Relative Frequency of Defects in Children from 33 Families on Diets below Standard in More than one Factor Arrayed on Average Number of Defects per Child per Family

Children in family	Total defects per family	Average Number Defects per Child						
		Total defects	Postural	Underweight	Tooth decay	Nasopharyngeal obstructions	Rickets	Other defects
1								
2	7	3.50			.50	1.50		1.50
6	23	3.83	.50	.17	.33	1.17		1.66
1	4	4.00				2.00		2.00
3	16	5.33	.67		.67	1.33	.33	2.33
5	29	5.80	.20	.80	.40	1.00		3.40
3	19	6.33	2.33		.33	1.67	.33	1.67
5	32	6.40	1.80	.20	.20	1.40	.20	2.60
3	21	7.00	.67		.33	2.33		3.67
1	7	7.00	2.00	1.00	1.00	1.00		2.00
5	37	7.40	.80		.60	2.60		3.40
5	37	7.40	1.80	.60	.40	1.20	.60	2.80
2	15	7.50	1.50	.50	.50	1.50		3.50
5	39	7.80	3.00	.20	.40	1.60	.40	2.20
1	8	8.00	1.00	1.00	1.00	2.00		3.00
3	25	8.33	1.00		.66	1.67		5.00
7	61	8.71	2.29	.57	.85	1.71	.29	3.00
2	18	9.00	2.00		.50	2.00	1.00	3.50
1	9	9.00	1.00			3.00	1.00	4.00
5	46	9.20	2.20	.20	.40	1.40	.60	4.40
6	56	9.33	2.00		.83	2.33	.17	4.00
5	48	9.60	2.80	.40	.60	2.40	.40	3.00
3	29	9.66	2.00	.33	.67	2.33	.33	4.00
4	40	10.00	1.00	.25	.50	2.50	.25	5.50
4	40	10.00	2.00	.25		2.25	.75	4.75
9	90	10.00	2.67	.44	.56	1.78	.66	3.89
3	30	10.00	1.67	.67		2.33	.33	5.00
3	30	10.00	1.67	.33	.33	3.00	.67	4.00
4	41	10.25	1.75	.50	.50	2.50		5.00
4	43	10.75	2.25	.75	.25	2.75	.50	4.25
7	76	10.85	1.85	.57	.85	3.00	.29	4.29
2	22	11.00	1.00		1.00	3.00		6.00
3	41	13.67	3.00	.67	.67	3.33	.67	5.33
Average								
3.73	31.48	8.08	1.53	.32	.48	1.99	.29	3.47

most mouths to feed are responsible for the greatest amounts of defective nutrition".

Relation of Specific Dietary Deficiencies to Specific Physical Defects.

In a study of this nature, it seems wise to limit the discussion to the general rather than the specific: (1) this is a study of family diets for the year of 1926, whereas the physical examination data is for individuals making up these families; (2) there are too few dietaries deficient in any one nutritive factor to draw any definite conclusions; (3) food is only one of the factors that determines physical condition.

Perhaps one is justified in bringing out the relation of a physical defect usually assumed to be somewhat related to a deficiency which occurred so frequently in these Mississippi dietaries, that of iron and pale mucuous

Sickness and Growth of Individuals in Study.

Table 23—Frequency of Symptoms Indicating Poor General Health

Condition	Adults		Children	
	131 cases Brown Loam	118 cases Short Leaf	170 cases Brown Loam	129 cases Short Leaf
	percent	percent	percent	percent
Frequent Colds	19.0	26.2	33.5	34.8
Constipation	30.5	34.7	11.2	12.4
Digestion Easily Upset	16.0	14.4	9.4	10.8
Headaches	17.5	15.2	4.7	.7
Rheumatism	19.8	22.8	1.7	4.6
Loss of Appetite	5.3	12.7	*	*

* Data not obtained.

Table 24—Average Number of Days Ill, Doctor's Visits, Visits to Dentist, and Cost of Drugs per Individual for Year of 1926.

Condition	Adults		Children	
	131 cases Brown Loam	118 cases Short Leaf	170 cases Brown Loam	129 cases Short Leaf
Days Ill	4.77	3.27	3.40	9.27
Doctor Visits	1.41	.83	.35	1.10
Visits to Dentist	.48	.31	.24	.13
Cost of Drugs	$1.03	$ .70	$ .34	$ .75

Table 25—Frequency of Illnesses among Adults and Children for the Year of 1926.

Illnesses	Adults		Children	
	131 cases Brown Loam	118 cases Short Leaf	170 cases Brown Loam	129 cases Short Leaf
	percent	percent	percent	percent
Treated by Doctor	13.7	19.4	18.2	28.6
Treated by Dentist	15.2	11.8	11.7	11.6
Infectious Diseases	22.9	35.5	32.3	75.1
Illness Due to Cond. of Stom'h & Intest.	6.1	7.6	5.8	17.0
Colds with Fever	5.3	5.0	9.4	5.4
Rheumatism	5.3	.8	1.1	
Bladder Trouble	5.3	1.6		
Skin Eruptions	2.2	.8	4.7	.7
Sick Headaches	2.2	1.6		
Operations	2.2	.8		1.5
Appendicitis	1.5		.5	2.3
Infected Ear	.7			
High Blood Pressure	.7			
Diabetes	.7			
Gallstones	.7			
Brights Disease	.7			
Kidney Trouble			.5	.7
Goitre			.5	
Tuberculosis				.7
Death—Heart Fail.		1 death		
Death by Colitis				1 death

The relatively high percent of infectious diseases among children from the Short Leaf Pine area was due to epidemics of mumps and measles.

membranes. 8% of the children* from the standard iron group had pale membranes while 21% of the children from the low iron group had pale membranes. This relation is at least interesting.

Of the symptoms indicating poor general health, constipation was found

Table 26—Rate of Growth for Boys during Year.

Short Leaf Pine Area				Brown Loam Area			
Age Group	Records	Increase in weight	Increase in height	Age Group	Records	Increase in weight	Increase in height
years	No.	pounds	inches	years	number	pounds	inches
- 1	1	12.00	8.5	- 1	1	14.50	8.75
- 2	3	5.33	4.83	- 2	4	4.62	4.25
- 3	5	3.90	4.20	- 3	8	4.31	3.93
- 4	5	3.80	3.25	- 4	3	4.08	3.25
5-7	6	4.16	2.16	5-7	15	3.73	2.21
8-11	10	6.40	1.92	8-11	23	7.15	2.04
12-13	8	9.68	2.09	12-13	11	10.00	2.13
14-15	4	12.75	2.87	14-15	6	13.16	2.91
16-18	3	6.66	1.41	16-18	8	7.50	1.50

Table 27—Rate of Growth for Girls during Year.

Short Leaf Pine Area				Brown Loam Area			
Age Group	Records	Increase in weight	Increase in height	Age Group	Records	Increase in weight	Increase in height
years	number	pounds	inches	years	number	pounds	inches
- 1	2	10.5	8.25	- 1	2	12.87	8.18
- 2	5	5.4	4.35	- 2	1	5.0	4.5
- 3	6	4.75	3.58	- 3	1	3.25	3.75
- 4	3	4.33	2.91	- 4	6	4.58	3.08
5-7	14	3.82	2.53	5-7	17	4.08	2.35
8-10	12	5.5	2.16	8-10	15	6.56	2.16
11-13	11	7.68	2.25	11-13	17	9.88	2.23
14-15	5	6.8	1.40	14-15	4	7.37	1.68
16-18	12	3.33	.31	16-18	7	3.21	.39

Increase in both weight and height was slightly greater for the Brown Loam group—which was probably due to the better health records of that group.

Table 28—Rate of Growth for Entire Group during the Year.

Boys				Girls			
Age Group	Records	Increase in weight	Increase in height	Age Group	Records	Increase in weight	Increase in height
years	number	pounds	inches	years	number	pounds	inches
- 1	2	13.25	8.62	- 1	4	11.68	8.21
- 2	7	4.92	4.49	- 2	6	5.33	4.37
- 3	13	4.15	4.03	- 3	7	4.53	3.60
- 4	8	3.90	3.25	- 4	9	4.49	3.02
5-7	21	3.85	2.19	5-7	31	3.93	2.43
8-11	33	6.92	2.00	8-10	27	6.08	2.16
12-13	19	9.86	2.11	11-13	28	9.01	2.24
14-15	10	12.99	2.89	14-15	9	7.05	1.52
16-18	11	7.27	1.47	16-18	19	3.28	.34

* From families keeping complete records.

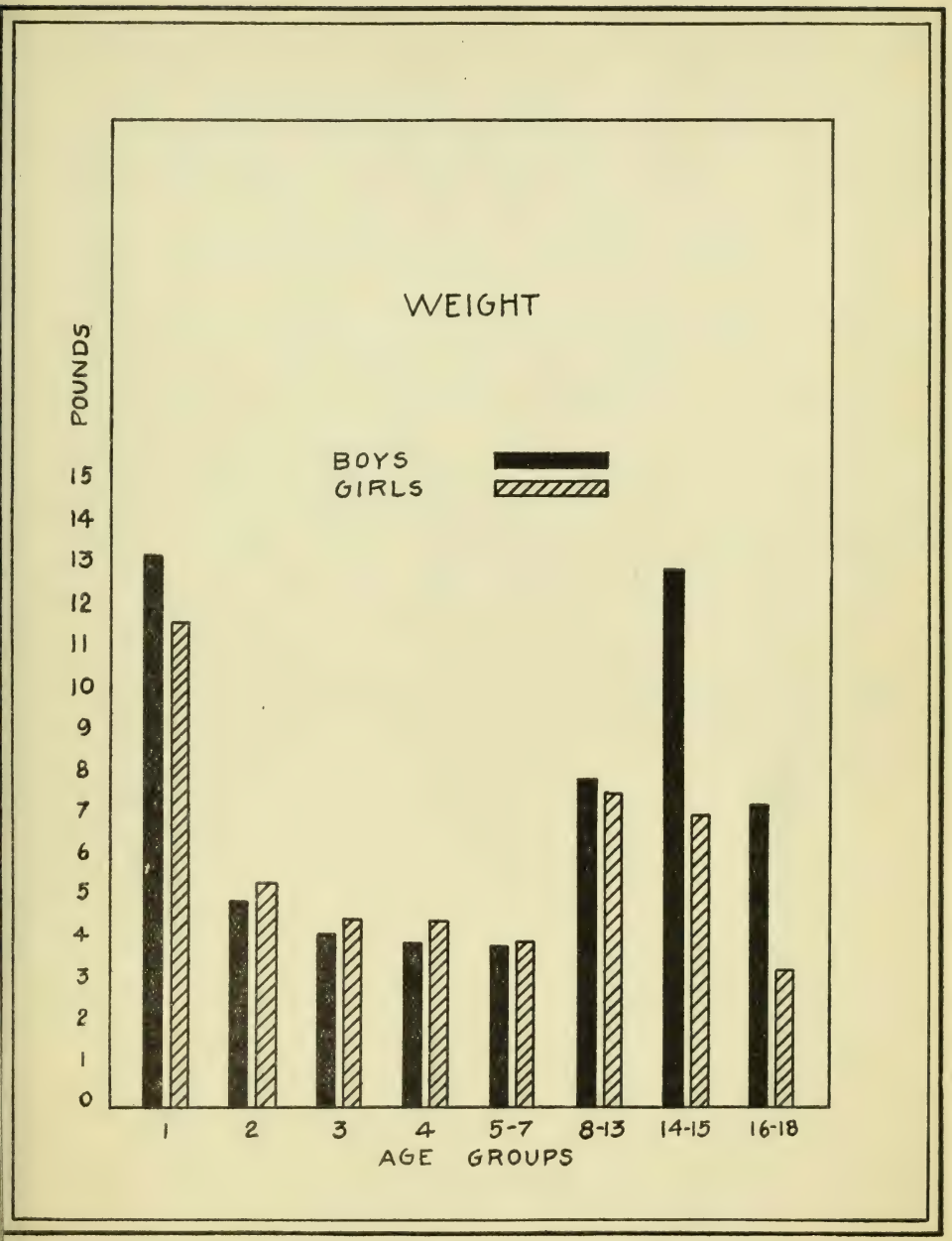


Fig. 15—Average rate of gain in weight for boys and girls during year of 1926.

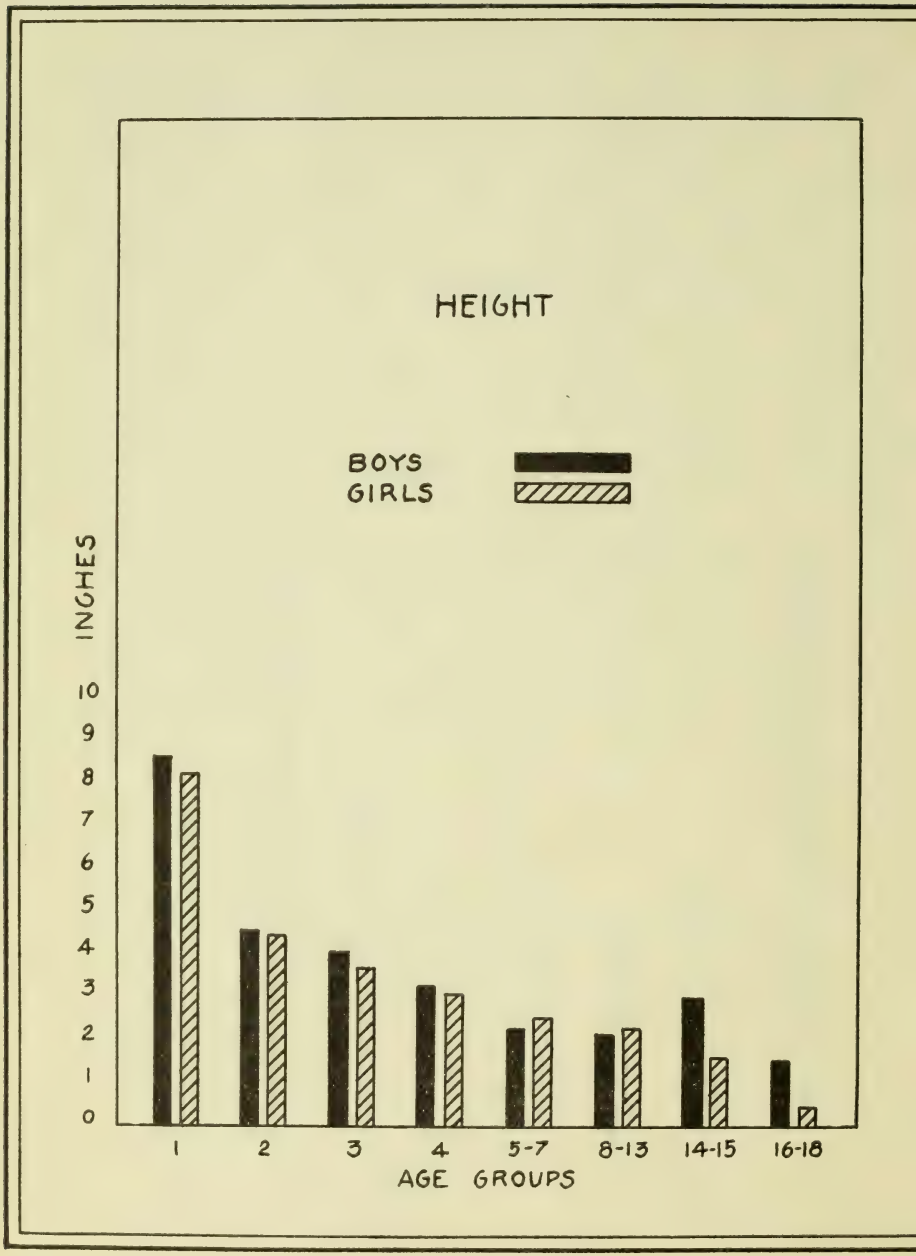


Fig. 16—Average rate of gain in height for boys and girls during year of 1926.

to be the most frequent among the adults, susceptibility to colds among the children. The large proportion of adults having constipation was probably due to large proportion of families on diets low in fruits and vegetables.

The relatively high percent of infectious diseases among children from the Short Leaf Pine area was due to epidemics of mumps and measles.

There were 299 children eighteen years of age or under in the 100 families included in the study. Physical examinations, including height and weight, conditions indicating general health, and illness records were obtained for all of these. Growth records were obtained from 264.

Increase in both weight and height was slightly greater for the Brown Loam group—which was probably due to the better health records of that group.

One cannot hope to draw any very definite conclusions concerning growth from only 264 records, but even these few records bring out a few well known facts. The average increase in height for both boys and girls from 5 to 16 years varied from 2 to 3 inches. There was much greater variation in increase in weight.

The average gain in height and weight was slightly above normal for practically all ages except the 5 to 8 year group. As noted in a previous table, there were a greater number of physical defects found among the 7 to 9 year group. Perhaps this partly explains the low rate of gain for the 5 to 8 year group. Average gain in height and weight for boys reached standards above normal more often than for girls.

Money Value of Foods Used.

Table 29—Average Money Value per Man per Day.

Type of Record	Records	Cost per Man per Day
	number	cents
Complete records Brown Loam area	38	38.13
Complete records Short Leaf Pine area	37	33.78
Complete records both areas	75	35.98
Total records 25 incomplete records included	100	35.40

Table 30—Frequency Distribution of Money Value* of Food per Man per Day.

Money value groups	No. of cases from Brown Loam area	No. of cases from Short Leaf Pine area	Total number of cases
cents	number	number	number
15-20	1**	0	1
20-25	1	4	5
25-30	3	9	12
30-35	7	9	16
35-40	11	5	16
40-45	8	7	15
45-50	3	2	5
50 thru 55	4	1	5

* Complete records.

** 19c per man per day.

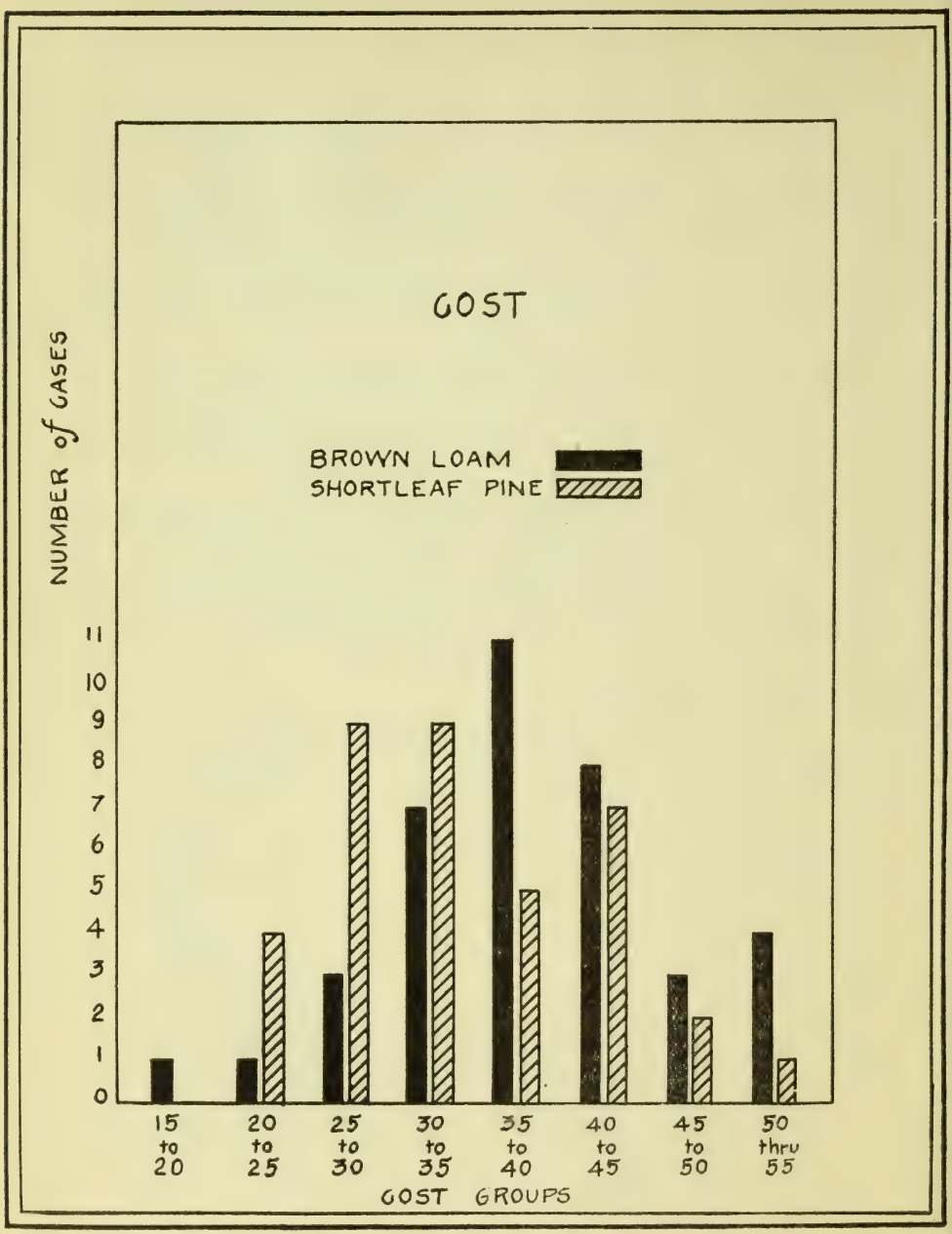


Fig. 17—Frequency distribution of money value of diets of families from the two areas.

The median occurs in the group from 35c to 40c. This corresponds rather closely with the general average.

The average money value of food consumed per man per day was $.354; per week $2.478; per year $128.856. The average value of food consumed per family per year was $644.28.

Due to the method of pricing food, comparisons cannot be made with Funk's study or with recent studies made by U. S. Department of Agriculture. In the study made by U. S. Bureau of Labor Statistics in 1918, $153.00 per man per year was spent. When adjustments are made to provide for difference in price level, we find that the same food would have cost the working man about $146.00 in 1926. This is around $17.00 a year more than for farm families.

In general, money values are poor bases for comparison. Milk varies as much as 25% in price from place to place. Fruits vary widely in price from place to place and from time to time. Meat has wide variations in price. The average retail selling price of a number of foods raised in quantities by Mississippi farmers was lower than the average selling price obtained for the same foods by the Bureau of Labor Statistics. On this basis the farmer's food was probably worth as much as, if not more, than the working man's. Yet it yielded around 17% more energy, 79% more calcium, and 15% more phosphorus.

In the study [1] made by the Office of Home Economics, food was valued at current retail prices, as in our study. These figures ought then to offer a good basis for comparison. The cost per man per day was 45c*, for the Mississippi study about 10c less. When adjustments are made to provide for the difference in price level between the year of 1917-18 and 1926, the difference is still about the same. This means that the farm diets in the Atwater study were worth about 10c more per man per day than the diets in the Mississippi study.

* Based on prices of 1917-18.

Table 31—Average Percentage Distribution* of Cost.

Section	Food Groups								
	1	2	3	4	5	6	7	8	9
	percent	percent	percent	percent	percent	percent	percent	percent	percent
Brown Loam	5.9	6.4	30.6	16.4	3.5	7.0	19.8	1.5	8.9
Short Leaf Pine	6.9	8.5	28.4	15.6	1.6	8.3	21.9	.9	7.9
Average	6.4	7.5	29.5	16.0	2.5	7.6	20.9	1.2	8.4

* Money value of edible food wasted taken from group corresponding most closely, eg. cornbread and biscuit from group 9.

Little difference was found to exist in the distribution of money value among the food groups in these two areas.

Miss Gillett, in her work upon family nutrition problems for the New York Association for Improving Conditions of the Poor, has suggested a family budget which allows one fifth, more or less, for fruits and vegetables; one fifth or more for milk and cheese; one fifth or less for meats, fish, and eggs; one fifth or more for bread and cereals, and one fifth or less for fats, sugars, and other groceries and food adjuncts. The Mississippi dietaries meet most of these requirements. The fruit and vegetable group meets Miss Gillett's standard, yet the group furnished just a little over 7% of

the calories. Our families evidently selected more expensive fruits and vegetables than allowed for by this budget.

In the 224 dietary studies referred to by Sherman*, meats and cereals furnish a greater proportion of the money value; whereas milk, sweets, fruits, and vegetables furnish a lower proportion than is furnished by the Mississippi dietaries.

Food Purchased and Food Furnished.

Table 32—Percent of Food Furnished by Farm and Percent Purchased on Basis of Money Value.

Brown Loam Area	February	May	August	November	Average
	percent	percent	percent	percent	percent
Purchased	39.18	25.54	20.96	35.21	30.22
Furnished	60.82	74.46	79.04	64.79	69.78
Short Leaf Pine Area					
Purchased	20.85	22.14	21.73	24.64	22.34
Furnished	79.15	77.86	78.27	75.36	77.66

The Short Leaf Pine people purchased less food. Their farms furnished about the same proportions of food the year out. A lack of food on hand was more apt to mean for them lack of food consumed than for the Brown Loam group.

The Brown Loam group showed variations which one would naturally expect. That is, in February and November when production was slightly lower, they supplemented this supply with greater amounts of purchased foods. An average for the entire study shows that about 74% of the food was furnished by the farm. This average corresponds closely with the 74.5% found by Kirkpatrick for southern states [16].

Table 33—Percent of the Different Food Classes Purchased and Percent Furnished by Farm

Food	Month	Brown Loam Area		Short Leaf Pine	
		Purchased	Furnished	Purchased	Furnished
Meat and Fish		38.0	62.0	11.0	89.0
Fruits		45.0	55.0	22.0	78.0
Vegetables	February	33.0	67.0	31.0	69.0
Dairy Products		8.0	92.0	3.0	97.0
Poultry & Products		4.0	96.0	1.5	98.5
Meat and Fish		40.0	60.0	22.0	78.0
Fruits		37.5	62.5	22.5	77.5
Vegetables	May	13.0	87.0	27.5	72.5
Dairy Products		2.5	97.5	1.5	98.5
Poultry & Products			100.0		100.0
Meat and Fish		49.0	51.0	39.0	61.0
Fruits		17.0	83.0	7.5	92.0
Vegetables	August	1.0	99.0		100.0
Dairy Products		1.5	98.5	2.5	97.5
Poultry & Products			100.0	.5	99.5
Meat and Fish		52.0	48.0	35.0	65.0
Fruits		41.0	59.0	26.0	74.0
Vegetables	November	9.0	91.0	6.0	94.0
Dairy Products		5.0	95.0	6.0	94.0
Poultry & Products		6.0	94.0	1.0	99.0

* Page 555 [29].

As noted in the preceding comparison, meat and fruit showed a greater difference in percent furnished in the two areas and in the different seasons than did any of the other foods.

The average percent furnished by the farm for this Mississippi study was for: meat and fish 64%; fruit 73%; vegetables 84%; milk and products 96%; poultry and products 98%. In the bulletin **Food for Farm Families** the proportion furnished by these groups was estimated as follows: meat 75%; fruit 60%; vegetables 80%; milk and products 85%; poultry and products 100%. The Mississippi farmer evidently takes at least part advantage of his favorable soil and climate.

Relation of Money Value and Nutritive Value.

Table 34—Nutritive Value of Dietaries from Low Cost Groups per Man per Day.

Cost per man per Day	Records	Energy	Protein	Calcium	Phosphorus	Iron
Cents	number	Calories	Grams	Grams	Grams	Grams
19	1	2635	58.50	.71	.95	.0092
20	1	2338	64.90	.99	1.11	.0078
21	1	2907	64.95	.88	1.04	.0076
23	1	3125	70.32	.74	.96	.0121
24	2	2509	65.69	.68	.97	.0092
25	2	2649	70.81	.83	1.07	.0082
26	1	3278	69.13	.81	1.06	.0096
27	2	2769	72.88	.94	1.13	.0124
28	4	2808	75.18	1.02	1.22	.0107
29	3	2919	68.43	.91	1.14	.0113

Table 35—Nutritive Value of Dietaries from High Cost Groups per Man per Day.

Cost per man per Day	Records	Energy	Protein	Calcium	Phosphorus	Iron
Cents	number	Calories	Grams	Grams	Grams	Grams
47	3	3725	99.33	1.459	1.74	.0150
48	1	3715	103.33	1.310	1.61	.0163
49	1	4330	112.87	1.330	1.62	.0162
50	3	4129	104.43	1.810	1.99	.0149
55	2	4487	104.30	1.310	1.76	.0140

Low expenditures should not imply low food values. Adequate diets can be obtained at low cost, but most housewives have far too inadequate knowledge of food values to make every penny count. Spending large amounts often allows for errors. As has been put, "property takes away the defense by which the effects of ignorance may be evaded."

If amounts contained in food consumption records in Table 35 were reduced by about one third, the nutritive factors would be about standard in everything but iron, which would be too low. Food consumption records in Table 34 were about 7% under in calories and protein, but 33 1-3% in iron. If menus are planned by the hit and miss method, more money must be allowed to take care of errors. 44c per man per day was the average amount for which a satisfactory dietary was obtained. There were two housewives who obtained a satisfactory diet for 32c per man per day. Then $66.00 a month is a fair guarantee against an inadequate food supply. A knowledge of how to combine cheap foods to make a balanced and palatable dietary seems to be a need of the average housewife.

Relation Between Income and Food Expenditures.

Table 36—Cost per Man per Day of Dietaries* from Families in High and in Low Income Groups

Cost per Man per Day	Income	
	$2000 and Above	$1200 and Below
Cents	Number	Number
19	0	1
20	0	0
21	0	1
22	0	0
23	0	1
24	0	2
25	1	1
26	0	1
27	0	1
28	0	3
29	1	3
30	1	1
31	1	0
32	0	5
33	1	1
34	0	2
35	0	0
36	1	0
37	0	5
38	1	0
39	1	3
40	3	1
41	1	1
42	1	4
43	0	0
44	1	2
45	0	0
46	0	0
47	0	1
48	1	1
49	0	1
50	0	2
51	1	0
52	0	1
53	0	0
54	0	0
55	1	0
56	1	0
Average	$.397	$.352

* From families keeping complete and incomplete records.

The per man per day average was about 35c for the low income group, about 40c for the high income group. It is then evident that inadequate income is at least partly responsible for low cost diets, which are in turn partly responsible for poor diets. A large income is not a solution of all dietary ills, but a large income generally means better diets.

The percentages of the $2000 and over income group are slightly higher for groups 4, 5, 8, and 9—groups containing larger proportions of purchased foods.

Greater variation in choice of foods than in distribution of money value

Table 37—Average Percentage Distribution of Money Value for Income Groups.

Income Groups	Food Groups								
	1	2	3	4	5	6	7	8	9
	percent	percent	percent	percent	percent	percent	percent	percent	percent
$2000 and over	5.7	6.9	28.5	16.8	3.3	7.6	20.5	1.8	8.9
$1200 and over	6.7	7.5	29.0	15.7	2.0	7.7	21.8	.9	8.7

was found in these two income groups. For example, an average two week's food supply from the high income group contained 28 foods including 6 vegetables, and 3 fruits, whereas an average food supply from the low income group contained 22 foods, including 5 vegetables and 1 fruit.

This relation could of course be better shown with urban families, for many of our poorest families, as far as income was concerned, raised and consumed a variety of foods.

Money Value of Edible Food Wasted.

Edible food fed to animals was usually cheap food, such as butter milk, skim milk, cornbread, and biscuit. The value of this waste averaged $13.10 each day. This food was enough to supply 29 men with sufficient quantities of iron and excessive quantities of the other factors, at a cost of 45c per man per day. This was at a cost slightly higher than the average dietary containing sufficient quantities of all factors.

SUMMARY

A summary of the data collected from 100 representative families from two predominating soil areas in Mississippi follows:

(1) General averages show that scarcely more than was actually necessary of energy, protein, and phosphorus was provided; that calcium was well provided (.69 grams used as standard); that iron was not provided in sufficient quantities; that vitamin A and B requirements were probably met, and that vitamin C was perhaps low in the fall, winter, and early spring.

There were a greater number of diets deficient in one or more factors from the families of the Short Leaf Pine area.

(2) Little seasonal variation in nutritive values of these Mississippi dietaries was found. The little variation found was largely due to variations in milk consumption and in types of vegetables used. This was true of both soil areas.

(3) The average number of physical defects, of conditions indicating poor general health, and of illnesses, was greater for both adults and children from the Short Leaf Pine area. The rate of gain of the children from this area was less.

(4) The average number of defects per child per family was higher for the families whose dietaries were below standard in two or more nutritive factors.

(5) Families raising and selling large quantities of food products consumed more than families who did not raise or sell to any extent. On the other hand high consumption and high production did not always go hand in hand.

(6) Money value of dietaries varied from 19c to 56c, the average per man per day being greater for the Brown Loam Group.

CONCLUSIONS AND RECOMMENDATIONS

A general increase in the use of fruits and vegetables in the case of the majority, and the introduction of some form of meat once a day in the case of a few would have resulted in better dietaries.

Such deficiencies as these should not exist in dietaries from Mississippi, a state in which an all-year-round garden and any form of meat from beef to chicken is possible.

Animal studies have shown that there is a relation between diet and health. This relation must be close indeed when a relation between the diet of the family and the health of the individuals making up the family can be found.

The average Mississippi farmer can more easily afford from the standpoint of health and finances to put labor into raising food than he can to put cash into purchasing food. Then it behooves him to adopt this motto: "variety and quantity of food raised at home". With such a motto put into practice, Mississippi will produce a people more physically fit than ever before.

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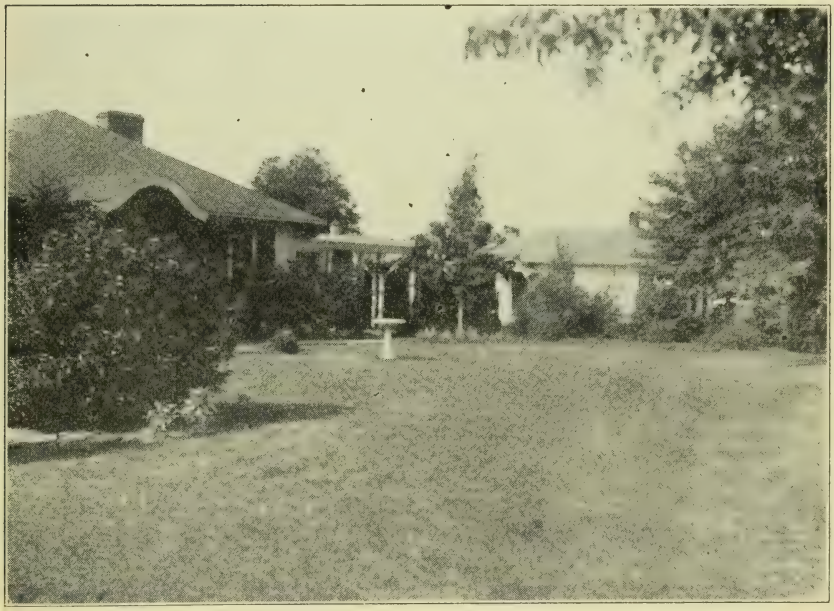
REPORT

SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION, 1927

By

E. B. FERRIS and W. S. ANDERSON



Office and Residence South Mississippi Branch Experiment Station

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

A Report of Work at the South Mississippi Branch Experiment Station for 1927

Introduction

Weather plays an important part in all agricultural work and has had a marked effect in the work of this station during 1927. While the temperature reached the low mark of 16 degrees here on January 16, it did not reach the frosting point a single day between January 17 and February 19. As a consequence of such abnormal conditions fruit trees such as peaches, pears and plums swelled both leaf and fruit buds later to have these seriously injured by succeeding cold spells. While the thermometer following this warm weather did not go below 29 degrees the condition of these buds was such that the fruit was entirely destroyed and a few such trees killed outright. We are gratified to report that neither the low temperature of January 16 nor the warm days following hurt Satsuma oranges in any way and the station and section generally are now harvesting the best crop of Satsumas ever grown here.

While 1927 has been a comparatively dry year, the rainfall was distributed in such a way during the fruiting season of cotton as to seriously affect such yields. Comparing 1927 with the two previous years it might be interesting to state that 1925 was possibly our best cotton year, the total rainfall from March 1 to November 30 being 31.08 inches. For the same time in 1926 this rainfall amounted to 46.95 inches, while for 1927 it was 40.31 inches. On the other hand the distribution of this rainfall in 1927 was such as to make it an excellent year for corn and sweet potatoes.

Cotton and Corn

Last year the results in our experimental work with corn were such that we did not feel they justified a separate report, but this year the yields were so good and the effects of the various treatments so outstanding that we feel a separate report is justified and the details of such work will be published in a separate circular. Experiments here and elsewhere over the section with cotton are much more elaborate than with corn and as usual this work will be published in a separate circular. As a result of our previous work with fertilizers under cotton where the use of potash so completely controlled rust and seemingly exercised considerable control over wilt, a good deal of additional work was started here in 1927 with the use of potash carriers under cotton. This additional work has been done in cooperation with Dr. D. C. Neal, Plant Pathologist of the Main Station, and will be reported in the regular cotton circular. This last named work showed up so encouragingly that the Potash Syndicate has agreed to donate the sum of $1500.00 annually to this station for doing further work with potash under cotton and this will likely be carried out in the same cooperative way with Dr. Neal as collaborator, or adviser.

Work With Oats

Oats are used here in relatively large quantities every year as a winter cover crop. Practically all our cropped land including considerable pasture is plowed or disced each fall and planted to some kind of cover crop, principally oats. Most of these oats are grazed thru the winter and plowed under in the spring, but some are allowed to mature and when possible we try to obtain some experimental data from them. In the winter of 1925-26 these oats did remarkably well and experiments showing the effects of nitrogenous fertilizers under them gave valuable information both as to the quantities used and the time of application.

In the winter just passed some very elaborate experiments were carried out here on some 100 plots of land planted to the Bayliss oat and until rust struck them in the spring these experiments were most promising. However, the abnormal weather above mentioned was evidently responsible for the most severe attacks of rust we have ever seen and these experiments apparently showed very little. The same thing was true with all the oats we saw growing in South Mississippi. A press circular issued early in the year gave the essential details of this experiment which went to show that a complete fertilizer apparently gave best results and that whatever fertilizer is used should be applied early in the year, January applications having been much more effective than February and this last better than March. These results also showed that oats well fertilized and not grazed grew so rank that they completely smothered lespedeza planted with them. Regardless of how well fertilized, if the oats were grazed, this lespedeza has not been injured and the two crops together and continuously grazed have furnished the best pasture ever tried here. Several years before the same land used in this fertilizer test had been grown continuously to oats and lespedeza, the lespedeza reseeding every fall before being disced under and planted again to oats. Careful observations made while the oats were growing during the last season failed to show that the various kinds and amounts of fertilizers used under them had any influence over the control of rust. Figures are available showing yields in all these tests but we feel they are hardly worth publishing.

Winter Cover Crops

The station has continued to grow each fall and winter a number of winter leguminous cover crops. Press circulars have been issued several times during the year calling attention to the progress of this work. Last winter Bur clover, Hairy vetch and Austrian winter peas were successfully grown on rather large areas, but the peas were ruined in the early spring by attacks of plant lice and did not fruit. The Hairy vetch grew to full maturity but made little or no seed. The Burr clover seeded well and the same land has been continued to it after growing summer crops of corn and peas.

During the present fall increased acreages have been planted to these three crops, including two other varieties of vetch, Monantha and Spring, also an additional kind of Bur clover, the California, with small quantities of Crimson clover added. All these crops were planted here in October in time to get them up before the severe drought which came later

had dissipated the soil moisture. At this time, November 15, these crops with the exception of Crimson clover, are covering a number of acres with a carpet of green and are attracting the attention of our visitors. Some thirty acres, including much pasture land, have been planted to Bur clover and a number of acres to Austrian winter peas and Spring vetch, in addition to the land planted to oats.

Four acres of good land suited to experimental plots have been divided into 72 such plots and devoted to an experiment in 8 replications where we will try to determine the relative soil building powers of five of these legumes, plots without them having been left as checks. The crops used include Austrian winter peas, a combination of Hairy and Spring vetch, Monantha vetch, California bur clover and Crimson clover. This work is being done on limed and unlimed land and this land will be planted to cotton in April as a measure of the effects of the various treatments.

Lespedeza

Lespedeza is used here both as a pasture and hay crop. In wet years it makes a wonderful yield of hay, but in hot dry summers, especially when grown on hill land, it frequently is badly damaged, making very little hay. As a pasture crop it is not subject to such severe injury because the plants never attain a size that they cannot withstand such droughts. We mentioned under oats that when lespedeza was grown as a companion crop with oats and these well fertilized for heavy yields of hay or grain, the oats shaded the young lespedeza to the point of completely destroying the stands. This has never happened here where the oats were used as pasture and the size kept down.

This year we grew three new varieties of lespedeza from seed furnished by Dr. Suttle of the A. & M. College and by the Coastal Plain Experiment Station at McNeil, but stands obtained were poor. The same land will be continued to the same varieties another year with the hope that seed matured on it will give better stands. Lespedeza is also being grown here in rotation experiments and furnishes a good percentage of our pasturage along with bermuda and carpet grasses.

This fall eight acres of such pasture was plowed after the lespedeza had seeded and has been planted to California bur clover, properly inoculated and fertilized, with the hope of materially increasing the grazing period of the same and with crops that should reseed themselves every year. Interest in pastures throughout the section is greater now than ever before in the history of this station.

Station Visitors

Numerous visitors have come here throughout the year, including farmers led by County Agents and leading business men; school boys led by their teachers, largely Smith-Hughes instructors; fertilizer manufacturers and salesmen; scientists interested in special features of our work; and home seekers brought here by land owners or their agents who desire to show them what is being done with lands similar to the unused cut-over lands of South Mississippi. A day seldom passes now, regardless of the season,

that we fail to have one or more parties of visitors interested in some feature of our work. In particular we might mention a one day school for fertilizer manufacturers and salesmen held here last summer which brought together some sixty such men who spent the day listening to discussions about fertilizers and visiting the numerous plots on the station where different fertilizers had been used for various periods of time.

Publications

There were issued early in the year the usual annual report and the circular giving results of numerous experiments here and elsewhere over the section with cotton. Besides these there were issued from time to time throughout the year the following press circulars giving short accounts of timely work going on at this station and reported in popular style where it might easily be used by the papers: No. 252, Landscaping in South Mississippi; No. 254, Ranches Turned Into Cotton Fields; No. 263, Late Winter and Early Spring Weather Records for 22 Years; No. 264, Dismal Outlook for Cotton in 1927; No. 279, Cold Injury to Fruit Trees; No. 280, Rust in Oats; No. 286, Results with Leguminous Cover Crops, 1926-27; No. 288, Save the Peach Orchards by Cultivation and Fertilizers; No. 289, The Entomologist—An Appreciation; No. 297, Notes on Oats and Lespedeza; No. 291, Irish Potato Source of Seed Test; No. 296, An Invitation to Visit the South Mississippi Experiment Station; No. 298, The Boll Weevil Situation in South Mississippi; No. 302, The Effects of Potash on the Control of Rust in Cotton; No. 303, Potassic Fertilizers for Cotton in Mississippi; No. 314, Cooperative Work with Fertilizers under Cotton in Lamar County; No. 315, Further Observations on Potassic Fertilizers for Cotton; No. 317, Experiment Station Activities; No. 318, Old Fertilizer Test Plats at Poplarville; No. 319, Cooperative Fertilizer Work in Pike County; No. 320, Varieties of Cotton Tested in Pike County; No. 322, Satsuma Orange Development. Some five or six other manuscripts for press circulars have been prepared and submitted, but as yet have not been printed and given numbers.

Such press circulars have been widely copied by South Mississippi papers and have been used by County Agents as a basis for recommendations in their work. While all of these circulars have not given strictly experimental data, they have largely been based on work done here in the past or being done for the future and should serve a useful purpose.

Cooperative Work with State Plant Board

The State Plant Board has continued to keep a representative at Poplarville whose office is on the station. Mr. J. E. Lee is the present representative and has assisted us in many ways in the control of insect pests and plant diseases. The growing of sweet potato plants for use in the weevil infested areas of South Mississippi has been continued on land furnished by this station. In addition to this Mr. H. H. Wedgworth of the Plant Board has cooperated with the horticulturist here in doing work with certified Irish potato seed and with the assistant director in testing several organic mercury compounds in the control of root and ear rots in corn. In other ways too numerous to mention these gentlemen have aided us in the work of the station.

Tests with Organic Mercury Compounds

As above mentioned we cooperated with Mr. H. H. Wedgworth, Associate Plant Pathologist of the State Plant Board, in comparing the effects of two organic mercury compounds on the control of root and ear rots in corn and one seed stimulant. This work was done on comparatively new land where evidently these rots have never developed for in other fields here the root rot had given considerable trouble in the past. Mr. Wedgworth treated Mosby seed corn with these compounds and sent such treated seed with some untreated to be planted here. This was done in six replications of each and observations made throughout the growing period to see the effects. No differences that the eye could detect ever developed and the final weights of corn failed to show that they exerted any influence. The untreated plats yielded at the rate of 53.5 bushels per acre; seed treated with Semesan Bel, 53.0 bushels; with Bayer Dust, 54.6; and with Stimuline, (a seed stimulant) 53.2 bushels. These differences were so small that they might well be attributed to experimental error. Results of work with Irish potato seed will be given by Mr. Anderson, horticulturist here, in another part of this report.

Work with Varieties of Cowpeas

The question of a variety of cowpeas that may be depended on to fruit well here is an important one. Practically all varieties, not seriously subject to nematodes, grow well here and make heavy yields of forage, but few such varieties fruit well. In work previously done here a local variety commonly known as the 6-weeks pea has fruited remarkably well and for

No. 2—Six-Weeks Cow Pea

several years this station has grown and distributed these peas in a small way. Several bushels of such peas grown here early this year were furnished the station at McNeill and are being used now in feeding tests with hogs to determine whether or not such hogs fed on peas and corn will fatten out hard. Our station is cooperating with the one at McNeill in fattening some of these hogs grazed on peas, soy beans and corn.

This 6-weeks pea has been planted at intervals here this year extending from March to September. Reasonably early plantings of them have all fruited well, plantings in mid-summer have not fruited so well, while similar plantings made very late have also fruited well, the differences apparently being due to the character of the weather at or near the fruiting period. Wet weather at this time seems to interfere seriously with such fruiting.

These 6-weeks peas were planted here this year along with five or six common varieties after a crop of oats. All varieties made good growths of vine, but none except the 6-weeks made any fruit whatever, and these fruited only fairly well due to showery weather at the fruiting period. We have had many letters from parties widely apart to whom small quantities of these peas had been furnished, saying they had done remarkably well, outyielding any variety they had ever tried.

Sorghum Variety Tests

On May 25 seed of 17 varieties of grain sorghums, sent here by the Delta Experiment Station, were planted on small plots. The land was fertilized in the same way as that on which corn varieties were grown on adjoining plots.

As the seed of these varieties ripened the heads were cut and weighed, giving yields as follows calculated in pounds per acre: Red Amber, 1020; Black Hull Kaffir, 600; Pink Kaffir, 420; Double Dwarf Milo, 840; Premo Dwarf White Milo, 780; Double Dwarf, Milo, Extra Fancy, 892; Hegari, 735; Dorso, Bred Up, 1207; Sagrain, 576, 3780; Sagrain, 303-437, 3937; Sagrain No. 309, 3255; Schrock Kaffir, 2520; Spure Feterita, 708.

Included among these sorghums were Honey and Gooseneck, each of which made heavy growths of stalks and much grain, but ripening seed much later than the ones above mentioned, caused hundreds of birds to concentrate on them, thus destroying the grain to the point where we never considered it advisable to cut and weigh. Birds also gathered much of the grain from the other kinds, but made no such inroads on it because their efforts were scattered. Two varieties of millet, German and White Wonder, failed to germinate tho planted the second time.

Of the ones tested and weighed, the Sagrains were by far the best producers of grain, Schrock Kaffir coming next. The Sagrain and Schrock Kaffir had much the same habits of growth, but seemingly the Sagrains were much sounder and less badly affected by insect or fungus troubles that attacked the heads.

While the weights of the Sagrains were no larger than those of corn growing nearby, it was planted almost two months later at a time when corn here seldom makes the best yields. Too, 1927 has been an especially good year for corn while the sorghums will withstand adverse weather

conditions, especially droughts, much better than will corn. Seasons here when crops of this kind are ready to harvest are usually so damp that in the past we have found it next to impossible to save dry forage when so coarse as are the sorghums, whether they are saved as hay or in shocks as corn is cured in other sections. Therefore we simply cut the heads out of these sorghums and made no effort to save the stalks. With the large proportion of grain, these Sagrains should make a very rich silage and as such the entire plant could be utilized here.

Tobacco

The same work started with bright leaf tobacco last year was continued in a smaller way this year. The Southern Railway, thru one of its agricultural agents, Mr. R. O. Lawhon, furnished the expert assistance in the growing of this tobacco. Only an acre was planted this year and fearing to plant where the crop had grown the year before, we selected this acre as near as possible to the curing house, this being the only land available that would not take that already in use for other experiments.

This acre was on land newly cleared the year before and rather too full of decaying vegetable matter to give a perfect seed bed. At the time of setting the young tobacco the weather was very dry and altho water was used many of the plants died, requiring resetting several times in order to get a stand. This resulted in our having plants of many ages at the time of curing, causing a very poor product, the leaves as pulled were either too old or too young and there was not enough of it to properly divide and cure each kind.

We have found that this tobacco grows well here and seemingly should yield as good a product as can be grown any where, but it requires the attention of well trained workers at all times from the planting of the seed to the selling of the tobacco. We had no such well trained labor here and had to depend in the main on school children to do a large part of the work. Insects were especially bad, especially the bud worms, which did their work so under cover that the damage was not seen until too late, a pin hole in the small leaf growing to the size of a dollar in the matured plant. This tobacco was regularly poisoned against such insects, but in the end considerable damage was done by them, especially the bud worms.

With the same class of labor that actually produce tobacco in other sections we feel that it might be grown equally well here, but from the standpoint of profit we must confess it has been at a loss, as grown by us. When common labor must be paid 20 cents an hour and grumble when told to string tobacco rather than chop cotton, even the closest supervision is not sufficient to make them produce a high grade product. It is a crop that requires infinite detail by ones who are personally interested in the result and does not lend itself to the use of labor saving devices that must be used when labor is as high as it is here in a country of saw mills.

Improved Varieties of Sugar Cane

Three years ago, Dr. D. C. Neal of the main station, sent us several varieties of mosaic resistant sugar canes which were grown here and distributed generally to the farmers of South Mississippi as they manifested

an interest in it and would come and get such cane. The first year they refused to come for it altho it was given free of charge, but as mosaic increased in the common canes, their interest increased until a year ago we could not supply the demand. With Dr. Neal, we finally interested Dr. P. A. Yoder of the division of sugar plant investigations, U. S. Department of Agriculture, who early this year supplied us very small quantities of more than forty varieties of new canes and agreed to put on a cooperative experiment at this station in the growing of such canes. These varieties were planted here early in the year and Dr. Yoder has recently been here and tested out the many kinds grown, planning to increase the better kinds in a planting next year.

This work will be continued until sufficient quantities of the best varieties can be grown for general distribution over the section. Up to this time this cane occupies a very small area but it is possible that much land might finally be needed to carry the work to the point of accomplishing the greatest good. Practically all the cane grown here this year has been banked for increased plantings another year, only a very few of the varieties having been discarded as a result of the elimination test just given them. Mosaic is fast spreading over South Mississippi and the time is close at hand when the common varieties of cane cannot be grown at all, at least this is to be expected judging by the seriousness of the situation in our neighboring state of Louisiana.

Soil Fertility Tests

Mention has been made in previous reports of work here where in four replications of eight plots each we are testing the soil building properties of three common summer legumes grown alone and with corn as compared with a check plot that grows corn only. Cotton is used as the crop with which to follow these and measure such effects. In 1926 cotton following such a system of crops made materially greater yields as a result of following these legumes grown alone or with corn. In 1927 these plots came back to these various crops with results as follows: plot 1 of each series, planted to peas alone, averaged 1225 lbs. of peas per acre; plot 2 of each series planted to soy beans was not harvested, the beans being gathered by hogs; plot 3 of each series, planted to velvet beans, was not harvested except by hogs; plot 4 of each series, planted to corn and cowpeas, yielded 6.1 bushels of peas and 33.7 bushels of corn per acre; plots 5 and 8 of each series, planted to corn and soy beans, yielded 27.2 bushels of corn per acre, the beans being harvested by hogs; plot 6 of each series, planted to corn and velvet beans, made 29.4 bushels of corn per acre, the velvet beans being harvested by hogs; plot 7 of each series, planted to corn alone, averaged 40.1 bushels per acre. These results differ considerably from those of 1925 when the same crops were harvested and weighed, in that the soy beans reduced the yields of corn more and the velvet beans considerably less. Just why these differences we are not prepared to say.

No. 3—Corn and Soy Beans

Rotation Experiments

For the past six years we have mentioned in all our reports work being done here on 21 plots, repeated four times, and testing 12 cropping systems. This work was continued in 1927 and the outstanding feature of it has again been the fact that where cotton has been continuously planted every year on the same land, diseases, principally wilt, have practically destroyed the stands, especially where the land is predominantly sandy. This was true in 1926 and to an even greater extent has been true in 1927. Several of the plots this year that had grown cotton continuously made less than 100 pounds of seed cotton per acre, whereas plots nearby on which the crops had been rotated made more than 700 pounds, all ridiculously low but certainly in favor of the rotations, for otherwise they had received exactly the same treatments. More will be said about these rotations in the circulars on corn and cotton.

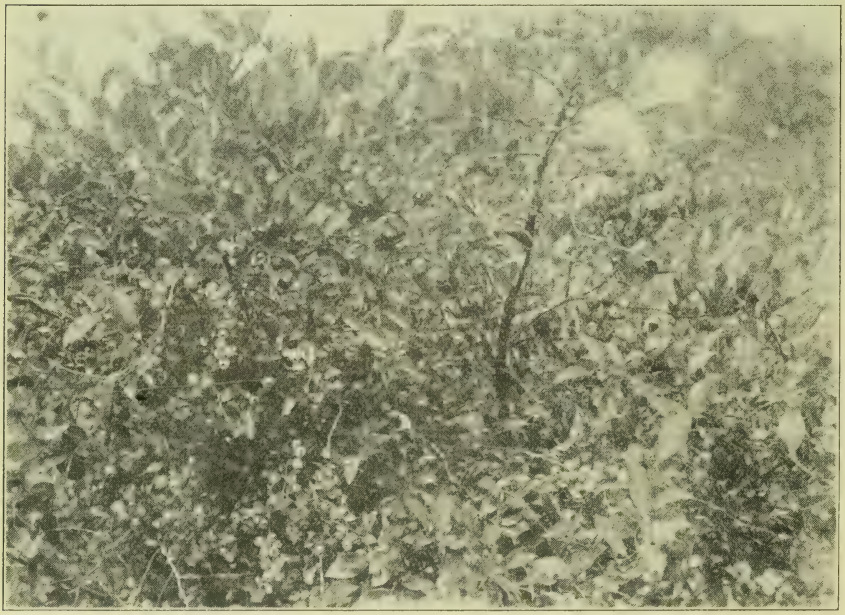
HORTICULTURE

Plant Selection Work

Sweet Potatoes—The work started here several years ago in the selection of Nancy Hall sweet potatoes in an effort to test the benefit of "hill selection" for the improvement of the quality and yield, has been continued this year. For the second year now the results of this selection have been such as would tend to show that there is little to be gained. This year our

strain which has been designated "H Y" (high yield) made 51.9 bushels of number 1 potatoes; while the other one, called "L Y" (low yield) made 74.4 bushels of number 1 potatoes.

Blueberries—Continued observations have been made this year of the several selections in the field of Florida blueberries. There are three fairly definite types evident, and representative plants of these have been selected for future watching. From these selected plants root cuttings and several kinds of stem cuttings were made last winter and sent to the A. & M. College to Prof J. C. C. Price, who is cooperating with this station in some propagating investigations with the blueberry. These cuttings, when rooted, are to be planted at both stations.



No. 4—Florida Blueberry Bush Showing Cluster-habit of Fruiting

Cucumbers—In cooperation with the American Pickle Company at Wiggins, Mississippi, there was started here this year some selection work designed to improve the productivity, earliness, and shape of pickle type cucumbers. Through this company's field agent, Mr. George Klumb, there was secured from the Heinz interests in Colorado a sample of cucumber seed to use as a starter in the work. Something like a half acre of land was planted to this cucumber this year. Careful observations were made daily when fruiting started, and certain vines selected for their desireableness. Seed from these plants will be planted next year for further selection.

Fertilizer Tests

Tomatoes—The work with fertilizers under tomatoes started here in 1925 has been continued in 1927 on the same plots. Due to the fact that the check plots made little or no yields last year, a basal mixture consisting

of 300 pounds acid phosphate, 160 pounds nitrate of soda, and 50 pounds muriate of potash per acre was applied to all plots uniformly, and the different formulas put on in addition. Marglobe, a wilt resisting variety recently originated, was used and fair yields were obtained. Table No. 1 shows results of this year's test.

Table No. 1—Tomato Fertilizer Record, 1927.

Pounds Material applied per acre			Formula	Crates No. 1 Tomatoes per acre			Dollars per acre		
Acid Phos.	Nit. of Soda	Mur. of Potash		Plat Yield	Check Yield	Increase	Value of Increase	Cost of Fert.	Net Gain
No Fertilizer				128.3	128.3				
600	320	200	8-4-8	181.4	119.6	61.8	61.80	18.66	43.14
600	320	150	8-4-6	212.4	110.8	101.6	101.60	17.46	84.14
600	320	100	8-4-4	356.2	102.0	254.2	254.20	16.26	237.94
No Fertilizer				93.2	93.2				
600	320	50	8-4-2	203.9	85.0	118.9	118.90	15.06	103.84
600	320		8-4-0	205.4	76.8	128.6	128.60	13.86	114.74
600	640	100	8-8-4	153.2	68.6	84.6	84.60	25.62	58.98
No Fertilizer				60.4	60.4				
600	480	100	8-6-4	217.2	67.8	149.4	149.40	20.94	128.46
450	320	100	6-4-4	248.4	75.2	173.2	173.20	15.14	158.06
300	320	100	4-4-4	149.3	82.6	66.7	66.70	14.00	52.70
No Fertilizer				90.1	90.1				
900	480	150	8-4-4	179.2	84.6	94.6	94.60	24.39	70.21
1200	640	200	8-4-4	190.9	79.2	111.7	111.70	32.52	79.18
No Fertilizer				73.7	73.7				

Sweet Potatoes—The test of fertilizers under sweet potatoes started here in 1925 has also been continued on the same land which is located in the "Moody Field". The Porto Rico variety was used again this year, plants

Table No. 2—Sweet Potato Fertilizer Record, 1927

Pounds of Material applied per acre			Formula	Pounds of Potatoes per acre					Dollars per acre		
				Plat Yield		Check Yield		Inc.			
Acid Phos.	Nit. of Soda	Mur. of Potash		No. 1	No. 2	No. 3	No. 1	No. 1	Value of Increase @ 2c	Cost of Fert.	Net Gain
No Fertilizer				8378	1884	1521	8378				
300	160	100	8-4-8	13029	1744	1206	7865	5164	103.28	9.33	93.95
300	160	75	8-4-6	11193	1819	1461	7472	3721	74.42	8.73	65.69
300	160	50	8-4-4	11364	2234	1515	7078	4286	85.72	8.13	77.59
No Fertilizer				6806	1741	1342	6806				
300	160	25	8-4-2	9594	1777	1285	6600	2994	59.88	7.53	52.35
300	160		8-4-0	9379	1951	1405	6394	2985	59.70	6.93	52.77
300	320	50	8-8-4	10741	1408	1616	6188	4553	91.06	12.81	78.25
No Fertilizer				5982	1209	1221	5982				
300	240	50	8-6-4	9918	1617	1185	6275	3643	72.86	10.74	62.12
225	160	50	6-4-4	10636	1869	1283	6568	4068	81.36	7.57	73.79
150	160	50	4-4-4	10101	1646	1170	6861	3240	64.80	7.00	57.80
No Fertilizer				7153	2001	1261	7153				
600	320	100	8-4-4	13218	1326	1194	7385	5833	116.66	16.26	100.40
900	480	150	8-4-4	13381	1050	782	7617	5764	115.28	24.39	90.89
1200	640	200	8-4-4	13674	795	1001	7849	5825	116.50	32.52	83.98
No Fertilizer				8082	1653	1388	8082				

having been set in the field on May 23. Seasons have been very favorable this year for the production of sweet potatoes in this section and fine yields were harvested from our test plots on October 31. The work is done on seventeen plots in each of three series and the results shown in Table No. 2 represent the average of all three series.

Pecans—The work with fertilizers under bearing pecan trees which was started in 1925, and in which Governor Bilbo has been cooperating by furnishing the orchard for the work, has been continued as heretofore. In this experiment amounts of an 8-5-3 fertilizer per tree have been varied from 25 pounds to 50 pounds, and the time of application has been varied so that in some cases the plots receive 50 pounds per tree in March and in others they receive per tree 25 pounds in March and 25 pounds in June. No results can be reported on this work as no crop has been secured from the trees since the experiment was started.

Peaches—Realizing the need for some additional data on the fertilization of peach trees in this section, this station started an experiment in 1927 designed to test the effects of a dozen different treatments with fertilizers applied to this crop. A block of land on the station grounds proper, consisting of approximately six acres, was set in February to June bud trees of the Belle of Georgia variety. The orchard is so laid out as to make sixteen plots of nine trees each in two series separated by an untreated row, and each two fertilized plots are separated by an untreated row.

The amount of material per tree is being varied as well as the composition, and the plan calls for an increase each year of one pound per tree of each treatment, starting out this year with three pounds per tree as a standard first-year application.

In addition to the fertilizer treatments this orchard is being intercropped with legumes in both winter and summer. Austrian Winter peas were grown last winter and plowed under in the spring. Laredo soybeans were planted immediately following these peas and when mature this fall these were cut and cured for hay, while the stubble was disced under and the land planted again to Austrian Winter peas.

Strawberries—An experiment was started in 1927 testing a dozen different treatments with fertilizers under strawberries. Approximately one acre of land in the "K. Smith Field" was divided into sixty-six three-row plots, fifty feet long, by ten and one-half feet wide. Fertilizers were applied and land prepared on February 26 and plants of Klondyke variety were set out on March 10. This was too late of course for a crop to be made this year, but fine plants have been produced and the plats should make good crops in 1928.

Variety Tests

Fruits—Continued observations are being made of the many varieties of various fruits under test here in an effort to determine the best adapted ones for both home orchard use and for commercial plantings. Due to very unfavorable weather conditions during the winter no fruit was made by any of the peach or plum varieties this year A freeze came in the latter part of February immediately following about one month of unprecedented warm weather for winters here, which had caused the trees to either swell their

buds or even in some cases open blossoms. This cold injured them to the extent of destroying the crop for this year and weakening the trees very severely. With dilligent attention given to fertilizers and cultivation, however, it is expected that these trees will resume their former vigor and bear normal crops in 1928.

The additional ten varieties of peaches planted in the winter of 1925-26 have made wonderfully fine growth during the present year and should produce a crop of fruit next year. There was planted this year another addition to the peach varieties including twelve varieties not commonly grown in this section. Some of these have been showing themselves to be promising in other Coastal Plains plantings, and it is hoped they will furnish additional satisfactory trees for the home orchardist in this section.

The several varieties of apples are continuing to look rather questionable, although some have not yet been injured by blight, and a few bore a small crop of fruit this year. These include Day, Shockley, Red June, Winesap, Delicious, Red Astrachan, Hackworth, Moore, Sorsby, and Kinnard's Choice. Both Florence and Hyslop Crab made a few fruits this year. Three varieties of apples were added to the test this year.

The several varieties of Japanese persimmons again made favorable crops of fruit this year. The twelve varieties of pecans have made good growths this year but only an occasional nut was borne.

The dozen varieties of figs in the test made as good crops this year as we have been getting in spite of the fact that growth had started when the freeze above mentioned came. It may be recalled from previous reports from this station that figs do not seem to do as well under orchard conditions as they do under door-yard conditions. Trees grown under clean cultural methods make enormous growths and usually set considerable crops of fruit, but this fruit invariably in the case of most varieties, drops off before it ripens. This is especially noticeable with the Celeste, the most popular one used in this section for home plantings. When grown under permanent sod culture, the Celeste is a failure. Green Ischia, Black Ischia, and Brunswick, however, have made fair crops in some years under clean culture. Last winter a block of Celeste and Lemon varieties was mulched heavily with oat straw and no cultivation was given this year. The object of this is to determine whether or not one can obtain conditions with mulches which are favorable to the fruiting of these varieties. No observations are ready to be reported on this work at this time.

Besides the apples and peaches above mentioned as being added to the varieties in the test, there were several varieties of other kinds of tree fruits introduced and planted the past winter. Some were new introductions into this country by the U. S. Department of Agriculture, and others simply secured through nurserymen. They include two varieties of pears, two of Japanese cherries, four of Chinese jujubes, three of plums, one of Chinese Tung Oil, and one of Chinese evergreen chinquapin. Some of these are quite rare in this section and will therefore be watched with unusual interest.

Of the planting of some thirty-five varieties of bunch grapes in 1920 there are now only ten varieties growing in the test vineyards. Of this lot there are not more than six which are promising enough to be kept longer in the plats for observation. These include Delaware, Ellen Scott, Muench,

Herbemont, Lenoir, and Delicious. Replacing these unfavorable ones have been planted additional varieties including last year Winchell and Armalaga, and this year, Volney, Herbert, and Lucile. Others will be added from time to time.

The four varieties of muscadine grapes, James, Flowers, Thomas, and Scuppernong, made excellent crops again this year and continued to show themselves to be well adapted to the section. This group of grapes, while not completely "fool-proof" as regards management for success, is quite easy to handle. They require little spraying, but should be trained on a trellis, pruned annually, fertilized in the spring liberally, and cultivated as the regular farm crops. Using these methods there have been secured here yields as high as eighty-five pounds per vine.

No. 5—Showing method of training and pruning Thomas Muscadines

Observations have been continued on the experiment of Vinifera grapes grafted on American varieties as stocks, which were started here in 1923. Although there is little possibility of their going through another season alive, there are now two vines of Muscat-Hamburg on Ives and two of Chaselas-Fontainbleau on Ives living. These made very weak growths the present year and only a few small clusters of undeveloped fruit. Further cooperation with the Bureau of Plant Industry at Washington is being solicited for continued studies of the problems of growing the Vinifera or European grapes here.

Satsuma Oranges—Observations are being continued in the planting of Satsuma oranges made here in 1920. It will be recalled from previous reports that these trees were severely injured in the winter of 1923-24 by a freeze when the temperature went as low as 12 degrees. This cold injury was soon overcome because the trees had been protected near the ground

by embankments and the root system being strong forced out a vigorous growth the first season. The trees are now in fine shape and exhibit very little evidence of having ever been killed back by a freeze. Much has been learned about the proper way to handle Satsuma oranges for hardiness and these trees are bearing fine crops of fruit, annually. In spite of the occurrence last winter of a drop in temperature as low as 16 degrees F., our trees this year were able to hold and ripen crops of from one hundred up to four hundred oranges per tree. This fruit apparently has great possibilities in South Mississippi and it is only to be regretted that this station has not been able financially to conduct elaborate experiments with the growing of it commercially, especially with reference to fertilizers, cultural methods, and pest control.

Other Citrus Fruits—Normal crops have been made this year by the Nagami and Maruma varieties of Kumquat, and Dancy Tangerine. Lue Gim Gong round orange, of which we have one tree, made fifty fruits. The Parson Brown lost all leaves and at least 50% of the wood during the freeze of last winter when the temperature went as low as 16 degrees F. This was also the case with the Homosasa round orange, Foster grapefruit, Thornton Tangelo, and Pineapple round orange. The one tree of Meyer lemon in the orchard was completely defoliated last winter and at least 75% of the wood was killed. Elkins lemon suffered less injury and bore this year its first crop of 29 fruits. Duncan grapefruit exhibits reasonable hardiness here and bore this year 17 fruits of good size.

Vegetables—Approximately one acre of land has been set aside for home garden work, and an effort is being made to keep some sort of vegetable growing on this land all the year. At the same time, different varieties or strains of the same varieties are secured and planted in the garden and observations are being made of their several behaviors. As any conclusions are reached as to the relative values of varieties and kinds of vegetables for the home garden in the section, reports will be made of the same.

Watermelons—Preliminary work with varieties of watermelons was started here in 1926 when seven varieties were planted. The same varieties were planted again in 1927 except that Kleckley Sweet and Florabama were substituted for Ice Cream and Stone Mountain of the 1926 list. The land for this work this year was laid out so that the hills would be twelve feet apart each way. Ten hills were planted of each variety, and these were thinned to one plant in each hill. Each veriety received the same amount and kind of fertilizer and the same cultivation, the plowing being done across the variety rows. Table No. 3 gives results of the observations for this year.

Table No. 3—Watermelon Variety Record, 1927

Name	Date first Picked	Date last Picked	Ave. No. per vine	Ave. Wght. each melon	Wght. of largest melon
Kleckley Sweet	July 5	July 26	2.2	23.4	34.0
New Perfection	July 2	July 16	.7	29.4	39.0
New Schochler	July 8	July 26	1.4	35.6	44.0
Florabama	July 5	July 27	1.1	35.4	46.0
Wonder	June 29	July 16	1.5	28.2	46.0
Tom Watson	July 2	July 13	.6	31.8	42.0
Irish Grey	July 8	July 16	1.1	26.1	34.0

Seed Strains Experiments

The work started here in 1926 with various strains of certified and uncertified seed Irish potatoes has been continued in 1927, but with the cooperation of Mr. H. H. Wedgworth, Associate Plant Pathologist of the State Plant Board, the test has been carried out in a much more elaborate way. This work is being reported in Circular (75), published jointly by Mr. Wedgworth's department, the Raymond Branch Station and this station.

Berry Work—The Van Fleet raspberry planted three years ago has continued to grow luxuriantly and bears annually small crops of fruit. This variety may have value as a home garden berry. The Thornless dewberry seems well adapted to our conditions. The Young dewberry, a hybrid between the Phenomenal blackberry and the Austin-Mayes dewberry originating about 1905 in Louisiana, has been added to the list of berry plants this year. This berry has been planted in several locations in the Coastal Plains with fair success. The several varieties of **Rubus** Species introduced from foreign countries and planted here several years ago have shown themselves entirely unsatisfactory, and are being eliminated from the experiments.

Nematode Control Experiments—Studies are being continued in the work with culture as related to the inhabitation of the roots of peach trees by nematodes. The entire block of trees devoted to this work is pretty well infested now, and careful observations are being made of the several plots. No crop of fruit was made on the trees this year, but measurements have been made this fall since all growth had stopped, and the figures obtained which compare the size of trees on various plots are given in Table No. 4.

Table 4—Comparative Growth of Peach Trees in Culture Tests

Variety and Culture used	Average Diameter of trunk in inches	Average height in feet	Average Spread of Branches in feet
Hiley, Permanent Sod	3.6	10.0	9.6
Elberta, Permanent Sod	3.4	7.8	7.7
Hiley, Clean Culture	7.2	11.8	15.6
Elberta, Clean Culture	7.2	12.0	14.2

Propagation Experiments—The work with propagation of pear stocks is being continued with the same poor success as heretofore. Again last winter one hundred cuttings each of Pyrus Calleryana No. 1 and No. 2 were put out, and a count today reveals that only four cuttings of No. 1 rooted and one of No. 2 rooted. The trees sent here by Mr. F. C. Reimer of the Southern Oregon station in the beginning of the experiment are still growing with much vigor and hardiness, but there seems to be little chance of the cuttings being easily rooted here.

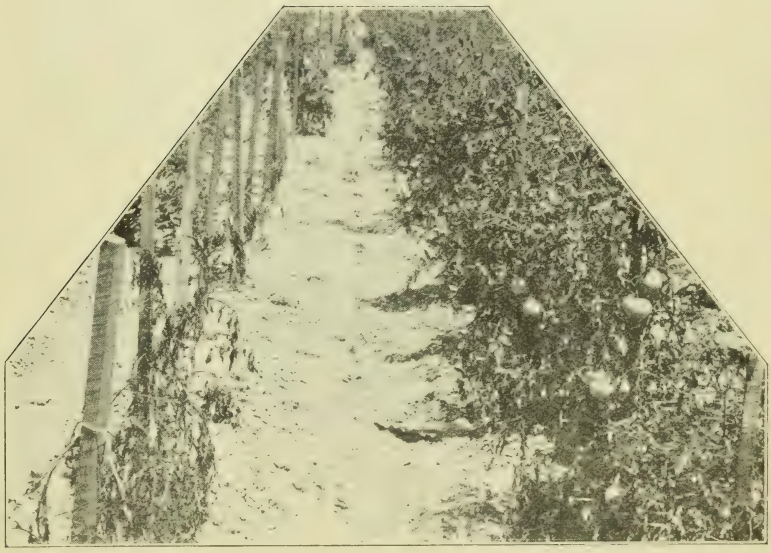
BULLETIN NO. 247 DECEMBER, 1927

WILT AND BLOSSOM-END ROT OF THE TOMATO

By

H. H. WEDGWORTH

D. C. NEAL and J. M. WALLACE



Non-resistant Stone Wilt-resistant Norton

Mississippi Agricultural Experiment Station
A. and M. College, Mississippi
J. R. Ricks, Director

WILT AND BLOSSOM-END ROT OF THE TOMATO
VARIETAL SUSCEPTIBILITY

By

H. H. Wedgworth, Associate Plant Pathologist, State Plant Board.

D. C. Neal, Plant Pathologist, Experiment Station and State Plant Board.

J. M. Wallace, formerly Asst. Plant Pathologist, State Plant Board.

The tomato is one of the most important truck and garden crops in Mississippi, ranking second only to the sweet potato in value of vegetable crops. The value of the commercial tomato crop was less than $2,000,000 in 1919 and nearly $5,000,000 in 1926. With this increase in the tomato crop, as with the intensive production of all crops, plant diseases have become an important limiting factor in economical production. The two most important of these diseases are Fusarium wilt and blossom-end rot.

WILT

Tomato wilt was reported as being common in the State in 1912 and has probably been prevalent for several years. It has now spread to practically every county in the State and is probably the most serious parasitic disease of the tomato in Mississippi. Before the introduction of wilt-resistant varieties, it was estimated to take an annual toll of about 25 per cent of all garden or midseason tomatoes. In 1920, wilt-resistant varieties were introduced into the State by one of the authors (Neal) and from 1922 to 1927 about 40,000 samples of wilt-resistant tomato seed were grown and distributed throughout the State by the Mississippi State Plant Board and the Mississippi Agricultural Experiment Stations. The use of these wilt-resistant varieties has probably reduced the loss from tomato wilt to about 15 or 20 per cent of the annual garden crop. Probably 4 or 5 per cent of the early truck crop of tomatoes is destroyed annually by this disease.

Symptoms. When the environment is especially fav-

orable for the development of the wilt fungus, it will attack plants in the seedling stage causing them to wilt, turn yellow, and die. Under more normal conditions, that is, a moderately cool soil temperature during the growth of the plants in the seed and plant beds, infection is not noticeable until the first fruits begin to form. At this stage, the dis-

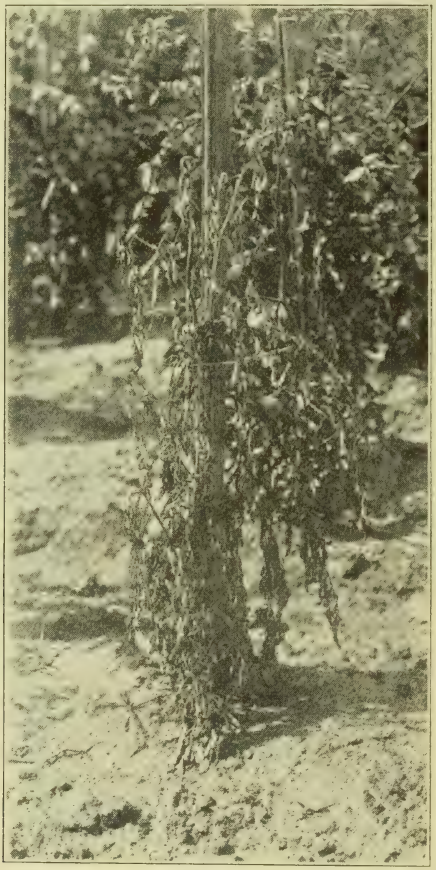


Fig. 1. Tomato plant of the Stone variety infected with wilt.

ease causes a yellowing of the lower leaves of the plant which progresses upward. This is usually preceded by a cessation of growth and accompanied by a wilting of the plants (fig. 1). Wilting is usually very rapid in susceptible plants but develops slowly in more resistant ones. Slightly infected plants may wilt during hot, dry

days and revive during the night. If hot weather prevails, however, this reviving at night will last for only a very short time. Many of the roots of infected plants soon rot making the plant easily pulled from the soil. When the stems of infected plants are cut lengthwise, the vascular or water conducting tissues appear as dark brown streaks extending up the stem and often extending into the leaf petioles.

Cause and Contributing Factors. Tomato wilt is caused by the fungus *Fusarium lycospersici Sacc.* The fungus hyphae grow from the infested soil into the small roots and after penetrating to the vascular bundles extend upward through the stem until nearly or all of the plant is invaded. Recent experiments have shown that the fungus secrets a toxic substance which causes the plant to wilt and die. It was formerly thought that the water conducting tissues were actually plugged to such an extent by the growth of the wilt fungus within these tissues that it caused the plant to wilt. After the plant dies the fungus pushes outward and produces spores or seeds on the surface of the stem. These spores may be readily carried from one plant to another or from one field to an adjoining one, by washing water or in any way that infested soil particles may be conveyed from one place to another. Seed from infected plants may be infested with the spores of the fungus and may serve to disseminate the disease. The fungus may live saprophytically in the soil for several years when it is once introduced.

The fungus develops most abundantly at a temperature of about 80 to 85 degrees F. which is reached about the last of May or the first of June in the trucking sections of the State. This explains why the disease is less severe in the early truck crop tomatoes than in those grown during the warmer seasons. It, also, explains the scarcity of the disease in the northern states. The fungus is favored by an acid soil although it will develop to some extent in an alkaline soil. The fungus develops very slowly if at all in very dry or very wet soils. It seems to develop most abundantly at a soil moisture content best suited for the development of the tomato plant.

Control. Since the wilt fungus can live for several years in the soil after it becomes infested, the following control measures are to be considered: (1) The prevention of the introduction of the organism on new soil by the use of disease-free seed or plants. Seed should be selected from healthy vines and the plants should be grown in soil that has never been planted to tomatoes before. (2) The practice of a long system of crop rotation. Although the fungus can exist for several years without its host plant and hopes of eradication by this method seem discouraging, experiments have shown that the amount of inoculum or fungus in the soil is reduced materially each year that the soil is planted to some other crop than tomatoes. Therefore, a four year or longer system of crop rotation is recommended for this disease as well as several other important diseases of the tomato. (3) The use of wilt-resistant varieties or strains of tomatoes. This is by far the most satisfactory and encouraging method in the control of this disease. Several wilt-resistant varieties have been developed by the various agricultural experiment stations and by the United States Department of Agriculture. These varieties have been developed by selecting healthy plants from heavily infested soils and also by hybridization. Many of these varieties, including the most promising ones, have been tested by the Mississippi Agricultural Experiment Stations for the past several years.

During 1920 to 1923 several selections of tomatoes were studied as to their resistance to wilt, yielding ability, fruit characters, etc. The main tests, however, were conducted during the seasons of 1924, 1925, and 1927.

WILT-RESISTANT VARIETY TEST FOR 1924

The seed of the various varieties which were used in this test were sown in flats in the greenhouse on February 11. The plants were transplanted to cold frames about the first of March and then to the field on April 21. The soil to which the plants were transplanted was a medium-heavy sandy loam soil to which about ten tons of stable manure had been applied per acre about four weeks before the plants were set. The plants were staked and pruned to one main stem until about the middle of July. The plants

Fig. 2. Experimental plats of tomato varieties during 1924. At left, wilt-resistant Norton. At rights, non-resistant Stone.

were not topped and the fruit clusters developed, of course, late in the season well toward the top of the plants. The fruits were picked on June 16, 22, 28, July 7, 17, 25, and August 3 and weights were taken on the sound fruits. Apparent wilt readings were made on June 23 and the actual infection determined by cutting the stems lengthwise on August 2. The results of this test are given in table 1.

TABLE 1

TEST FOR WILT RESISTANCE OF 12 VARIETIES OF TOMATOES IN 1924*

Variety	Apparent wilt June 23 per cent	Actual wilt by cutting stems August 2 per cent	Rank in resistance	Yield in pounds per acre
Louisiana Pink	1.9	41.7	5	17,180
Marglobe	1.5	29.5	2	15,680
Marvana	10.0	42.5	6	13,880
Louisiana Red	0.0	19.5	1	12,980
Marvelosa	6.8	38.0	3	8,880
Perfection	23.5	70.6	8	8,340
Norton	12.2	56.0	7	7,720
Marvel	5.8	40.0	4	7,500
Livingston's Globe	28.0	77.5	10	7,180
Gulf States	18.0	73.2	9	5,500
Red Field Beauty	54.3	93.4	11	4,780
Stone	55.6	98.5	12	4,480

*Average 3 plats.

WILT-RESISTANT VARIETY TEST FOR 1925

The same procedure used in 1924 was followed during 1925 except for dates of planting, harvesting, etc. which were approximately the same as those of 1924. The same soil used in 1924 was used for the 1925 test. The results of the 1925 tests are given in table 2.

TABLE 2

TEST FOR WILT RESISTANCE OF 12 VARIETIES OF TOMATOES IN 1925*

Variety	Apparent wilt June 18 per cent	Actual wilt by cutting stems July 28 per cent	Rank in resistance	Yield in in pounds per acre
Marglobe	3.5	32.4	2	16,280
Louisiana Red	1.6	39.2	3	15,460
Louisiana Pink	6.5	52.3	7	15,300
Price's A. & M.	4.2	48.5	6	12,540
Marvana	16.0	61.5	8	12,300
Marvelosa	8.6	42.5	5	11,760
Perfection	27.0	89.7	10	10,060
Livingston's Globe	31.2	88.8	9	10,040
Marvel	3.5	40.2	4	9,800
Norduke	1.5	29.2	1	7,680
Early Detroit	48.4	100.0	11	4,420
Stone	62.7	100.0	12	3,720

*Average 3 plats

WILT-RESISTANT VARIETY TEST FOR 1927

The same general plan outlined for the tests during 1924 and 1925 was followed during the season of 1927. In addition to wilt-infested soil as used in 1924 and 1925, the varieties were also grown on soil which was free of the wilt fungus during 1927. The results from the tomato tests on wilt-free soil are given in table 4 and are discussed briefly under the control of blossom-end rot. The yields, however, given in table 4 which indicate the relative productiveness of the various varieties under conditions similar to those of this experiment, should be compared with the rank in production given in table 3.

The seed for the 1927 test were sown in greenhouse

flats on February 7. The plants were transplanted to cold frames on March 8 and to the field on April 13. The soil in the field was of a light sandy loam type and had received an application of about 1000 pounds of an 8-4-4 (P-N-K) fertilizer per acre in the drill about ten days before transplanting. The soil was inoculated by placing about 25 grams of a mixture of sand and a strain of the wilt fungus, which had been isolated during the summer of 1926 and

Fig. 3. Experimental plats of tomato varieties during 1927. (A) Non-resistant Stone. (B) Wilt-resistant Norton.

which had been grown for about four weeks on steamed rice, in each hill as the plants were being transplanted. The plants were set 28 inches apart in row 3½ feet wide and 100 feet long. They were staked and pruned to two main stems until about the first of July. They were not topped, however, and the plants continued to form new clusters of fruit until late in the season. The fruits were harvested as soon as ripe, sorted into marketable and culls, and weighed in the field. The picking dates were as follows: June 16, 21, 25, 28, July 1, 5, 8, 11, 14, 19, 25, August

1, and 9. Wilt readings were made at intervals of about three weeks during the growing season. The data obtained from this test are given in table 3 which is self-explanatory.

TABLE 3

SUSCEPTIBILITY OF 14 TOMATO VARIETIES TO FUSARIUM WILT DURING 1927*

Variety	Apparent wilt in percentage				Rank in resistance	Pounds of marketable fruit per A.	Rank in production
	June 4	June 25	July 16	August 6			
Norton	.86	1.72	6.03	32.76	3	8856	4
Stone	49.57	74.36	93.16	98.29	13	1685	13
Louisiana Red	2.56	3.42	7.63	37.61	6	9405	3
Louisiana Pink	.85	.85	5.98	34.19	4	10000	1
Gulf States	23.08	45.30	65.81	92.31	12	5449	10
Marglobe	.86	6.03	9.57	37.07	5	9855	2
Kanora	7.83	9.57	12.17	46.09	7	6451	8
Globe	11.21	13.79	17.24	81.03	11	6179	9
Marvel	.85	1.71	4.27	19.65	1	8016	5
Marvelosa	2.59	2.59	25.86	70.69	9	6592	7
Perfection	16.67	28.07	38.60	73.68	10	4403	12
Marvana	7.69	10.26	11.97	29.06	2	7361	6
Columbia	8.63	12.07	18.96	62.93	8	5269	11
Detroit	51.30	72.17	91.30	99.13	14	1442	14

*Average 3 plats.

The data presented in tables 1 to 3 show conclusively that wilt-resistant varieties of tomatoes are the most effective means of preventing the enormous losses caused annually by this disease. There is a marked difference between the so-called wilt-resistant varieties. It is no longer sufficient to plant a variety of tomatoes because it is resistant to wilt without considering its other varietal characteristics even though resistance to wilt is fast becoming the most important prerequisite for a tomato variety for Mississippi conditions. Table 4, however, shows that the best wilt-resistant varieties of tomatoes compare very favorably with the best commercial non-resistant varieties even on non-infested soil.

BLOSSOM-END ROT

Blossom-end rot is often called black-rot, point-rot, or dry-rot. It has probably been present since the modern varieties of tomatoes first came into existence and occurs everywhere that the tomato is grown. Under certain environmental conditions the disease may cause a loss of the greater part of the crop. Under the same conditions, however, some varieties suffer a greater loss than others from this disease. Blossom-end rot is probably the most important disease of the early crop of tomatoes in the trucking section of Mississippi and is equally severe on the garden tomatoes. It takes an annual toll of about 10 per cent of the entire tomato crop of the State.

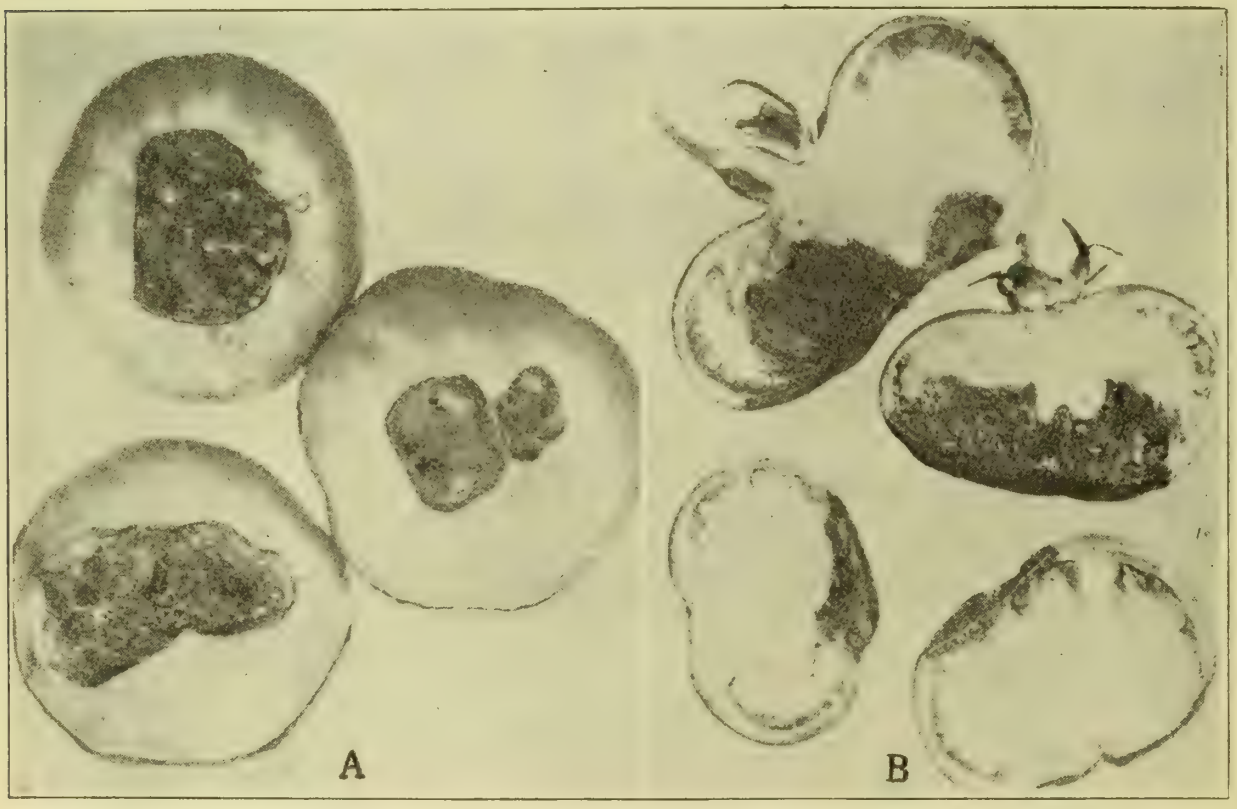


Fig. 4. (A) Blossom-end rot in advanced stage.
(B) Cross section of tomatoes with blossom-end rot. (After Stuckey).

Symptoms. As the name implies the disease affects the blossom ends of the fruit. The fruits seem to be most susceptible when they are one-half to two thirds mature but may be infected at all ages to maturity. The first indication of the disease is a small, water-soaked spot around or near the style. This spot becomes dark in color and may enlarge

to form a large spot which will involve more than half of the fruit (fig. 4). As the spot enlarges, the inner tissues shrink and the end of the fruit becomes flattened or sunken. The black discoloration may extend deeply into the tissues of the fruit (fig. 4). Unless saprophytic organisms gain entrance into the diseased tissues it becomes a firm, dry rot.

Cause. The cause of blossom-end rot is not very well understood. It has been quite clearly established, however, that the disease is not caused by a parasitic organism. The cause seems to be related in some way to transpiration or the giving off of water. It is known that the leaves have a greater osmotic pressure than does the fruit. Therefore, the leaves are able to take up more water than the fruit. Under cases of emergency the leaves take up the water that should rightfully go to the fruit or during a severe drought the leaves may actually draw water from the fruit. This, of course, would cause the fruit cells farthest from the roots to suffer first. Any condition, therefore, that would greatly increase transpiration or cut off the water supply would induce the disease. The most important factors affecting transpiration are soil moisture, humidity, sunlight, and fertilizers.

The lack of sufficient moisture is probably the principal contributing factor. An over supply of moisture will also induce the development of the disease if later the amount of water is cut off suddenly. The more succulent plants are the most susceptible to blossom-end rot during sudden changes of the water supply.

It has been found that strong sunlight tends to induce the disease. A comparison of strong, direct sunlight and diffused, weaker sunlight may be had from tomatoes that mature and ripen in midsummer when losses are usually heavy from blossom-end rot, and those which mature in the late fall when, as a rule, very little of the disease is present.

The question of fertilizers in relation to blossom-end rot is a much debated one. Heavy applications of unrotted stable manure which provide an excess of aeration and cause the soil to dry out rather quickly favor the develop-

ment of the disease. Some investigators state that increased amounts of potash may increase the amount of blossom-end rot materially while increased amounts of phosphate have little or no effect. The influence that nitrogen has on the disease has not been clearly demonstrated. Ammonia-carrying fertilizers are said to increase the disease. Nitrogen in the form of nitrates may not be detrimental.

Control. To prevent or lessen the losses from blossom-end rot the following points must be considered: (1) The soil moisture content should be kept as uniform as possible by giving good drainage, plowing deeply in fall or winter, providing sufficient humus, and irrigating where facilities are to be had. (2) Shading, to a limited extent, tends to reduce the disease. Spacing the plants as thickly as practical may aid in shading the fruits. However, under Mississippi conditions it is not usually practical to have the plants very thick or to have them unstaked to aid in shading the fruits because with the heavy rain-fall in this section soft-rot or ground-rot would cause serious losses. Excessive pruning should be avoided as it allows the fruits to become exposed to direct sunlight. (3) The use of unbalanced fertilizers seems to increase the disease, therefore, the fertilizer should be balanced for the needs of the soil. At any rate, heavy applications of ammonia-carrying fertilizers, and unrotted stable manure should be avoided. (4) Some varieties are more susceptible than others, although none of the commercial varieties are immune. Careful notes were made during the season of 1927 on the susceptibility of fourteen varieties of tomatoes in connection with studies on wilt-resistant varieties.

SUSCEPTIBILITY OF 14 VARIETIES OF TOMATOES TO BLOSSOM-END ROT

The fourteen varieties of tomatoes used in the wilt-resistant variety test in 1927 were also planted on wilt-free soil for a study of susceptibility to blossom-end rot, fruit characters, and yielding ability on non-infested soil. The dates of planting and harvesting, methods of culture, etc. were identical with those for the wilt test except that the

soil was not inoculated with the wilt fungus and was somewhat more fertile than the soil used for the wilt test.

The fruits were sorted into marketable and culls and weighed in the field. The culls were divided into various classes depending upon the cause; namely, blossom-end rot, cat-faces, mechanical injury, etc. The summarized results from these tests are presented in table 4.

TABLE 4

SUSCEPTIBILITY OF TOMATO VARIETIES TO BLOSSOM-END ROT AND NOTES ON OTHER VARIETAL CHARACTERISTICS DURING 1927

Variety	Character of fruit			Per cent blossom-end rot	Per cent cat-faces	Total per cent culls	Lbs. marketable fruit per acre	Rank in production
	Color	Av. wt. in lbs.	Order of ripening					
Norton	Red	.288	10	9.5	5.8	39.2	13,632	6
Stone	Red	.307	13	24.2	5.3	45.1	12,954	7
Louisiana Red	Red	.250	2	12.6	4.6	45.5	13,642	5
Louisiana Pink	Pink	.256	4	17.0	3.8	45.6	15,193	1
Gulf States	Pink	.271	6	6.7	3.2	41.9	14,267	3
Marglobe	Red	.291	3	5.5	2.8	33.5	14,566	2
Kanora	Red	.226	9	5.5	4.4	38.4	14,155	4
Globe	Pink	.265	8	12.9	4.8	48.1	12,124	9
Marvel	Red	.246	5	9.9	8.3	42.9	10,074	13
Marvelosa	Pink	.314	12	30.5	4.7	57.6	11,555	10
Perfection	Red	.267	7	9.7	13.4	54.4	12,155	8
Marvana	Red	.211	1	8.0	5.3	51.0	10,122	12
Columbia	Red	.266	11	6.6	16.0	49.6	8,734	14
Detroit	Pink	.295	14	17.1	8.3	45.9	10,860	11

*Average 2 plats

The data presented in table 4 show that there is a marked difference in the susceptibility of the various varieties of tomatoes to blossom-end rot. Although the results are for only one season, the writers believe the figures represent the relative resistance of the varieties to blossom-end rot, at least, for conditions similar to those under which the experiment was conducted.

WILT-RESISTANT VARIETIES OF TOMATOES FOR MISSISSIPPI

The reader should refer to table 4 for a comparison of the size, color, yielding ability, and relative earliness of the various varieties of tomatoes.

MARGLOBE

Marglobe is the result of a selection made from crossing the Globe with the Marvel by Dr. F. J. Pritchard of the U. S. Department of Agriculture. It is a very productive, second early variety. The fruits are medium large, smooth, red, and globular. The plant is highly resistant to wilt and is moderately resistant to blossom-end rot. This variety is replacing the Globe and other early trucking varieties in the Carolinas and in Florida for wilt-infested soils. It is suited to fertile soils and good cultural conditions. The Marglobe is one of the best wilt-resistant varieties for the home garden and is very promising as a shipping tomato. It is worthy of extensive trials by the truck growers of this State.

LOUISIANA RED AND LOUISIANA PINK

Louisiana Red and Louisiana Pink are the result of a selection made from crossing a wilt-resistant selection of Acme with Langdon's Earliana by Dr. C. W. Edgerton of the Louisiana Agricultural Experiment Station. These varieties have become widely known in several sections of the United States because of their resistance to wilt and their high yields of good quality fruits. The fruits of both varieties are medium-sized, and more or less globular in shape. They are second early varieties and produce vigorous plants which are highly resistant to wilt. They are among the best varieties for home gardens that have been tested at the Mississippi Agricul ural Experiment Stations.

NORTON

The Norton is one of the oldest wilt-resistant varieties having been selected by Professor J. B. S. Norton of the University of Maryland about 1914. It was later improved by Dr. F. J. Pritchard of the U. S. Department of Agriculture. The variety is very similar to the Stone in that it is

very prolific, matures rather late in the season, and produces large, smooth, solid red fruits. It is highly resistant to wilt and is one of the best late-season wilt-resistant varieties.

MARVEL

The Marvel was selected by Dr. F. J. Pritchard of the U. S. Department of Agriculture from Merveille des Marches (marvel of the market) a French variety sold by Vilmorin-Andrieus and Company, Paris, France. It is a medium early variety and produces medium-sized, smooth, deep red fruits. It is very resistant to wilt and produces vigorous growing plants. It is a good garden and trucking tomato.

MARVANA

The Marvana is the result of a selection made from crossing the Marvel with the Earliana. It is the earliest of the wilt-resistant varieties. It produces a good yield of medium-sized, smooth red fruits, and is highly resistant to wilt. This variety was also selected by Dr. F. J. Pritchard of the U. S. Department of Agriculture.

KANORA

The Kanora is the result of a selection made from crossing the Norton with the John Baer which was developed at the Kansas Agricultural Experiment Stations. In Kansas, it seems to be a heavy producer of medium-sized, smooth, deep red fruits. It has been tested in Mississippi for only one season and other trials are needed to determine its value under the conditions of this State. During the season of 1927 it was very prolific producing small, smooth, deep red fruits. It is very resistant to wilt.

SUMMARY OF EXPERIMENTAL WORK

Extensive tests on the resistance of tomatoes to wilt have been conducted for several years at the Mississippi Agricultural Experiment Stations in which about seventeen standardized varieties or strains and many new selections have been tested for resistance to wilt and blossom-end rot, fruit characters, yielding ability, etc. Several varieties have proved to be highly resistant to wilt and very desirable commercially. In fact, some of the wilt-resistant varieties seem to be superior to the best commercial non-resistant ones even on wilt-free soil. Marglobe has been an outstanding producer of high quality fruits each year that it has been in the tests. It is the most outstanding variety for early market and for long distance shipping. The Louisiana Red and Louisiana Pink are outstanding varieties for midseason, home garden varieties. The Marvana is the earliest of the wilt-resistant varieties and is also a heavy producer. The Norton is the outstanding late-season tomato.

Studies on the susceptibility of the various varieties to blossom-end rot were made during 1927. The Marglobe and the Kanora seem to be most resistant to this disease.

BULLETIN No. 248 FEBRUARY, 1928

MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

Cotton Diseases in Mississippi and Their Control

J. R. RICKS, Director

AGRICULTURAL COLLEGE, MISSISSIPPI

DISEASE	CONTROL MEASURES
Wilt	Plant wilt-resistant varieties. Use balanced fertilizers. Maintain adequate organic content in soil.
Rust	Use potash fertilizers. Add humus to the soil. Drain wet land.
Anthracnose	Select disease-free seed. Use resistant varieties. Rotate crops.
Bacterial blight	Select disease-free seed. Rotate crops.
Sore-shin	Fertilize plants liberally. Cultivate at frequent intervals.
Minor boll-rots	Rotate crops. Reduce injuries to bolls.

Cotton Diseases in Mississippi and Their Control

By

D. C. NEAL

Plant Pathologist, Mississippi Experiment Station

INTRODUCTION

Cotton is the most important money crop in Mississippi and in fact in all the Southern States. In Mississippi every county in the State grows more or less cotton. The hill and coastal plain sections produce with few exceptions very largely upland (short) cotton, whereas the Delta grows almost exclusively staple varieties. With growing of the crop State-wide in area, the matter of the losses from various plant diseases which attack the crop annually is of considerable economic importance and is beginning to claim the attention of growers more so than in the past. This increased interest in the cotton disease situation has been brought about partially by the advent of new varieties of cotton, some of which are more susceptible to plant diseases than others; and by the importing of planting seed from other states, a practice which has, no doubt, introduced specific diseases. The fact, too, that many growers are vitally interested in economical production and realize that losses from preventable diseases must be reduced to a minimum to insure maximum profits has increased this interest.

LOSSES CAUSED BY COTTON DISEASES AND SEASONAL VARIATIONS

The losses from cotton diseases in Mississippi, as in other cotton-producing states, naturally vary considerably from year to year and are determined by a number of factors, the more important ones being perhaps temperature and rainfall. However, the type of soil, the matter of soil fertility, and the length of time fields have been planted to cotton are other important factors which enter into the situation and determine the prevalence of diseases and the losses which they entail. The effect of weather conditions upon the prevalence of cotton diseases was strikingly illustrated in Mississippi in 1923. During that year the rainfall was considerably above normal and the combined

attack of insects and plant diseases, as well as other factors, cut the production to 604,000 bales. During the three years following, 1924 to 1926 inclusive, the production was 1,099,000, 1,990,537, and 1,887,787 bales respectively. The years 1924 to 1926 were favorable seasons for cotton growing and the losses from cotton diseases were estimated to be about 5 per cent each year for the State as a whole. On the other hand, during the wet year of 1923, the damage caused by boll-rots, leaf-blight and wilt was conservatively place at 15 per cent of the c

In spite of the general prevalence and importance various cotton diseases, many growers know little abo[illegible]r nature and seldom distinguish between them. For this reason, the principal cotton diseases which cause damage in Mississippi are described and illustrated in this bulletin, and the best known methods of combating them are given and are based on information collected from various sources and from experiments conducted at the Mississippi Experiment Stations since 1924.

WILT

The principal cotton disease in Mississippi is undoubtedly wilt. The loss caused by this disease is difficult to estimate but

Fig. 1. Wilted, mature cotton plant showing irregular branching. Note stunted infected main stem with lower branch normally developed.

a conservative estimate is in excess of 50,000 bales annually. The disease is widely distributed throughout the State and all soil types are more or less affected. The cotton plant is subject to wilt at an early date. When about ten or twelve inches high it is susceptible and from then on to maturity. In some instances, the plants are killed shortly after germination thus materially interfering with the obtaining of proper stands.

SYMPTOMS. The disease has the characteristic symptoms of all the wilts of its class and may be readily diagnosed. Cotton wilt may be suspected when plants wilt and die without any apparent reason. Such plants are usually stunted early in the season as compared with healthy plants and the leaves turn yellow at their margins and between the veins. Frequently, the main stem of infected plants remains short while one or more lower branches grow normally (fig. 1). The chief symptom of a plant infected with wilt is the characteristic internal appearance of affected stalks. If the stem of a freshly wilted plant is cut across near the ground and the tissue in the region of the water-conducting vessels shows brown or blackened areas, there is strong evidence

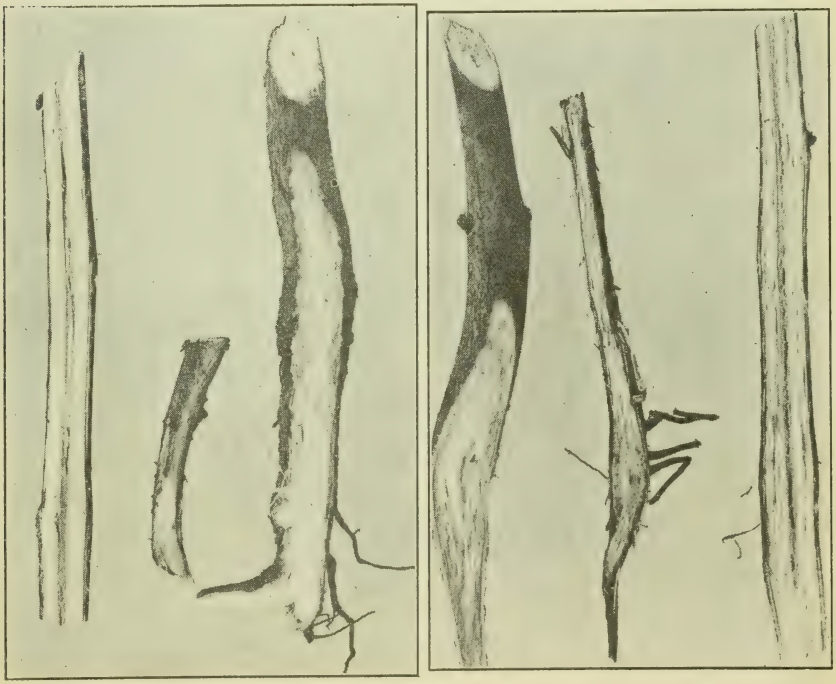


Fig. 2. Longitudinal sections of cotton stalks and roots showing appearance of healthy and diseased tissue. (A) healthy; (B) diseased.

of the disease (fig. 2). This vascular discoloration may extend up the stalk into the main branches and frequently into the leaf petioles and pedicels. Other symptoms of wilt are shorter tap roots, fewer lateral roots, and the excessive shedding of leaves producing bare stalks. The disease usually occurs first in irregular spots in the field which increase in size from year to year.

CAUSE. The cause of cotton wilt is one of the soil inhabiting fungi known as *Fusarium vasinfectum* Atk. It is able to live in the soil for prolonged periods of time; in fact, for several years, thereby making rotation as a control measure unsafe and impracticable. The fungus gains entrance into the plant through the root system and later by its growth forms toxic substances in the plant which finally accumulate in sufficient quantity to cause the plant to wilt and die. After the plants are killed, the fungus continues to grow within the tissues eventually rotting the roots and, later, if conditions are favorable, it forms spores (reproductive organs) in abundance on the basal portion of the stems and on the roots. The disease may then be spread from field to field by animals, cultivating implements, laborers, wind, drainage water, or by any other agency which may carry soil particles. So far as known, the disease is not disseminated in or on the seed. Experiments have been conducted by the writer for two years in which seed were saved from badly wilt-infected Delfos 6102 and Rhyne's Cook-Triumph hybrid plants and

Fig. 3. Delfos 6102 cotton plants. Grown from seed saved from wilted plants. Growing period 6 months. Note healthy appearance.

planted in sterile soil in pots in the greenhouse. Yet, after a period of six months, no disease developed (fig. 3). Gilbert (1) has found the same to be true while Elliott (2) thinks the fungus may be carried inside the seed coat.

CONTROL. The planting of wilt-resistant varieties of cotton combined with liberal fertilization of the crop with balanced fertilizers is perhaps the most feasible and economical means of controlling the disease. Measures that will maintain an adequate organic content of the soil are also important in decreasing wilt damage. For a number of years experiments have been conducted jointly by the Departments of Plant Pathology and Plant Breeding of the Mississippi Experiment Station with many varieties of both staple and short cottons for the purpose of obtaining information as to their resistance to wilt, yielding qualities, etc. It has been found as a result of these tests that many varieties of cotton differ materially in respect to their resistance and susceptibility to this disease.

WILT-RESISTANT VARIETY TESTS

Wilt-resistant variety tests were made at the Central Station in 1927 with 18 varieties and selections of staple and short cottons on soil which had been artificially inoculated so as to insure more complete exposure of the plant roots to the wilt fungus. The soil in the wilt variety test field was inoculated by using cultures of the fungus which had grown on steamed rice in 250 cc flasks for a period of ten days. Later the cultures were mixed thoroughly with about ten times as much soil by volume and a definite amount, approximately six pounds, distributed by hand in a shallow furrow which has been made previously on top of the rows. During the first week in May, the rows were planted to the different varieties and selections with a cotton planter in rows 125 feet long and 3½ feet wide. Each variety or selection included five series. On September 23-25, the per cent of wilt was determined in each variety by splitting the stalks for evidence of vascular discoloration. The performance record of the 18 varieties and strains of both staple and short cottons on wilt-infested soil which were included in the tests at the Central Station during 1927 and many of which were under test the preceding year are given in table 1.

(1) Gilbert, W. W., Cotton diseases and their control. U. S. Dept. Agr., Farmers' Bull. 1187: 1-32, 1923.

(2) Elliott, John A., Cotton wilt, a seed-borne disease. Jour. Agr. Res., 23: 387-393, 1923.

TABLE 1—TEST FOR WILT RESISTANCE OF 18 VARIETIES OF COTTON ON WILT INFESTED SOIL AT CENTRAL STATION. SEASON 1927

Variety	Wilt infected plants per cent	Rank in resistance	Yield per acre pounds		Lint Length inches	Rank in value
			Seed cotton	Lint		
D. & P. L. 4128.A21.32	35.6	11	1432.8	500.8	1 1/16	1
D. & P. L. 6	19.5	7	1329.6	416.8	1 3/16	2
Watson	25.3	8	1260.0	405.7	1 1/8	3
D. & P. L. 8	32	9	1226.4	463.0	1	4
Super Seven	7	2	1197.6	397.0	1 1/8 f	5
Lightning Express	13	4	1128.0	384.1	1 3/16	6
D. & P. L. 52.116.310	38.6	12	1137.6	435.7	1 f	7
Miller	13.6	5	1255.2	406.1	1 1/16	8
Dixie Triumph	9.3	3	1238.4	421.7	15/16	9
D. & P. L. 4	34.8	10	1036.8	374.8	1 1/16	10
Cleveland 54	17	6	1156.8	394.5	15/16	11
Delfos 6102	63.8	16	1017.6	313.4	1 1/8 f	12
Lone Star 168	59.3	15	996.0	338.1	1 1/16f	13
Cook, Rhyne	5.7	1	1034.4	366.2	7/8	14
Delfos 245	65.8	17	904.8	284.1	1 1/8 f	15
D. & P. L. 2842.A17.34	51.5	14	842.4	283.0	1 1/8 f	16
Delfos 1341	71.3	18	724.8	233.0	1 1/8 f	17
Trice	46.5	13	789.6	247.5	1 1/16	18

Since these experiments have been in progress considerable difficulty has been experienced in finding varieties which yield moderately well under varying conditions. Sometimes a variety may be very resistant to wilt, but on the other hand, it may not be prolific, it may not mature early, or it may not be satisfactory for areas where the boll weevil is a serious factor. Some of the varieties included in the 1927 wilt tests are shown in figure 4. The results indicate that the most promising wilt-resistant staple cottons are Super Seven, Lightning Express, Watson and D. & P. L. No. 6. The most promising wilt-resistant short cottons as indicated from these tests are Rhyne's Cook, Dixie Triumph, Miller, and Cleveland 54. The column reporting the rank in money value is based on pounds of lint per acre plus the value of the seed, and the lint prices for the different varieties represent an average of five southern market centers based on the prevailing prices for middling grade of the indicated lengths.

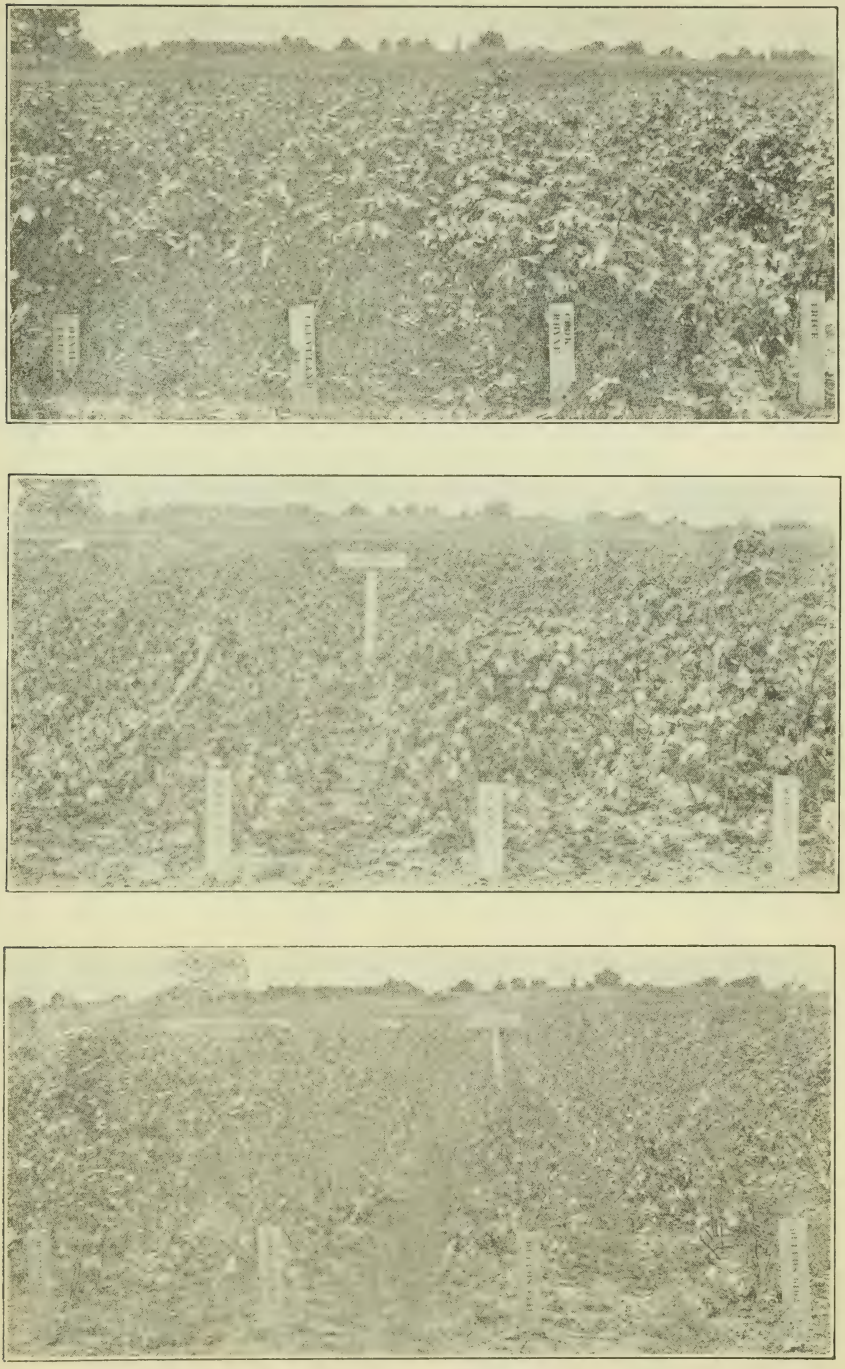


Fig. 4. Variety tests for wilt-resistance. Season 1927.

EFFECT OF FERTILIZERS ON COTTON WILT

The writer has had the subject of the effect of various fertilizer treatments upon the development of cotton wilt under investigation since the fall of 1925. A detailed report of these experiments up to and including the year 1926 is now in press and will appear later in the November, 1927, issue of the Annals of the Missouri Botanical Garden and also as a technical bulletin of the Mississippi Experiment Station. During 1927 these experiments have been continued and somewhat enlarged both at the Central Station and at the South Mississippi Branch Station at Poplarville.

FERTILIZER EXPERIMENTS FOR COTTON WILT CONTROL AT CENTRAL EXPERIMENT STATION, A. & M. COLLEGE. SEASON 1927

The work on the effect of fertilizers on cotton wilt at the Central Station in 1927 was a continuation of similar experiments inaugurated in 1926. It consisted of plats of 1/40 of an acre in size and these were interspaced with checks or unfertilized plats and arranged so that all treatments were replicated three times. Both checks and fertilized plats were inoculated with cultures of the cotton wilt fungus, *Fusarium vasinfectum*,

TABLE 2—EFFECT OF FERTILIZERS ON COTTON WILT CONTROL CENTRAL STATION. SEASON 1927*

Fertilizer formula	Treatment Rate per acre in lbs.	Wilt infection per cent	Yield per acre pounds seed cotton
8-4-8	600	6.6	1100
8-4-4	600	8.0	1072
8-4-0	600	15.0	692
Check	---	35.5	124
8-8-4	600	5.8	1040
8-6-4	600	9.0	1004
8-0-4	600	9.5	648
Check	---	32.5	256
6-4-4	600	9.0	960
4-4-4	600	8.1	920
10-5-5	600	7.0	932
Check	---	21.8	148
8-4-4**lime	600	7.0	848
8-4-4	900	6.5	936
8-4-4	1200	6.0	1220

* Average 3 plats.

** Lime applied at about 4500 pounds per acre to approximately neutralize soil.

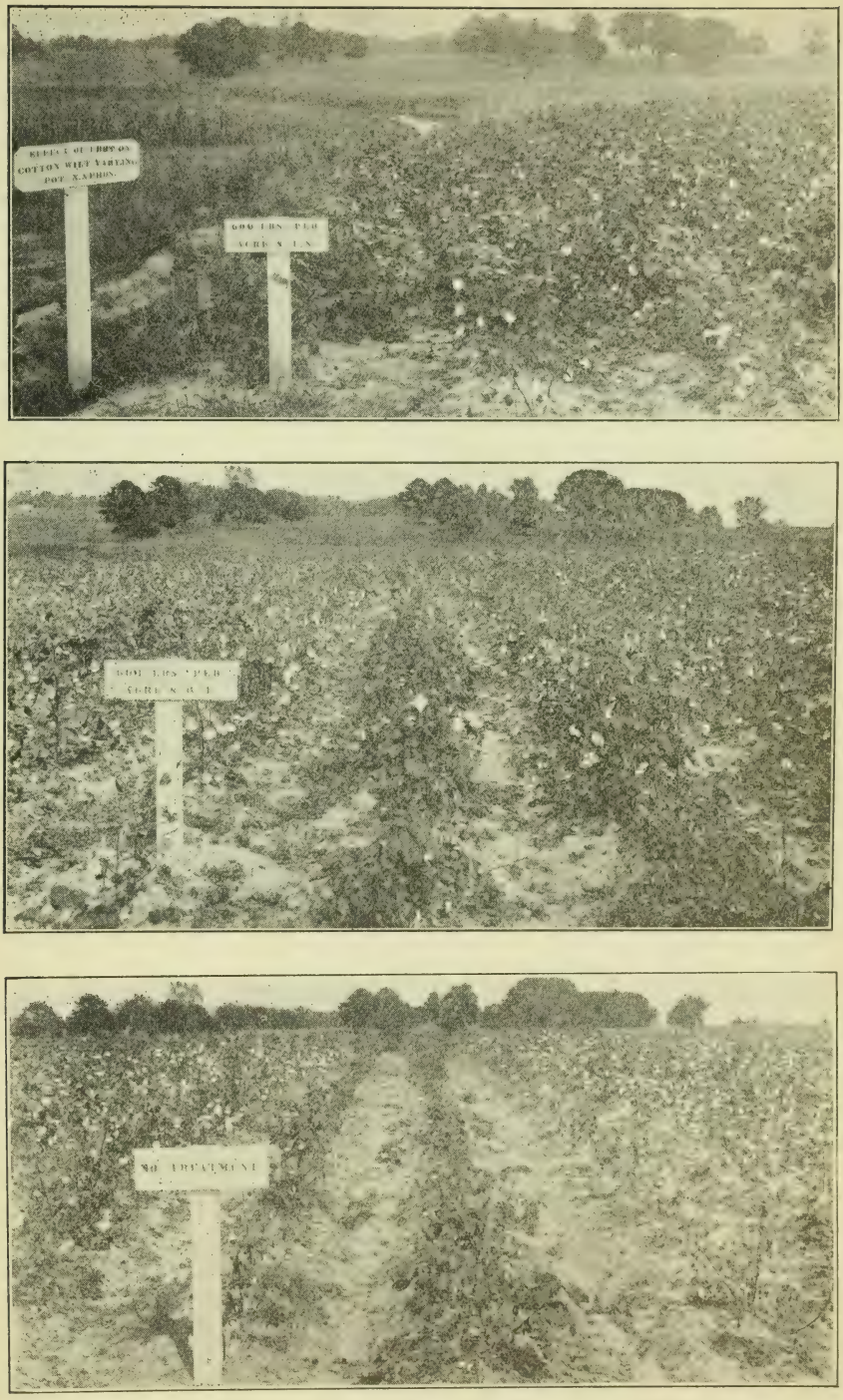


Fig. 5. Effect of fertilizer on cotton wilt control. Season 1927.

prior to planting in much the same manner as described under the wilt variety test for resistance. The plats were planted with Lone Star 65 cotton on April 23. They were given the usual cultural treatment throughout the summer and on September 5, 6, and 7 the yield records were taken and the percentage of plants infected with wilt determined by cutting the stems of each plant near the ground line for evidence of vascular discoloration. The results are given in table 2.

It is noted from the data that the amount of wilt infection is materially reduced in the plats which were fertilized as compared with the checks or unfertilized plats. In other words, the amount of wilt in the unfertilized plats ranges from approximately 15 to 23 per cent higher than those which received some form of fertilizer treatment. The plats which did not receive potash appear to have developed considerably more wilt than the ones to which potash was added; whereas, the minimum amount of infection is observed to be in the plats receiving high amounts of nitrogen and potash. There appears to be very little difference in the amount of wilt infection in the plats which received varying amounts of phosphorus and in the ones where the soil was approximately neutralized by the addition of lime to the fertilizer. Neither did increasing the amount of fertilizer from 600 to 1200 pounds per acre, using 8-4-4 as the basic formula, show any material difference in the amount of wilt. Some of the plats were photographed on August 9 when they were approaching maturity and are illustrated in figures 5 to 7.

It would appear from these experiments that the matter of the proper amount of balanced fertilizer is important in reducing wilt damage by giving the plant increased vigor and enabling it to overcome the attacks of the fungus until it has matured a large portion of the bolls. Undoubtedly, a much higher percentage of wilt infection could have been obtained if counts had been made later or several weeks after the cotton was picked. None of the elements in the fertilizer treatments used can be considered in any sense a specific for cotton wilt control. However, it is believed that where a soil is deficient in either phosphorus, nitrogen, or potash the addition of this plant food will give the plant increased resistance to the disease. Where a soil is deficient in potash, this fertilizer should by all means be applied, especially where wilt is scattered throughout the field. The addition of potassium undoubtedly prevents rust, a nonparasitic disease of cotton which will be discussed later, and by

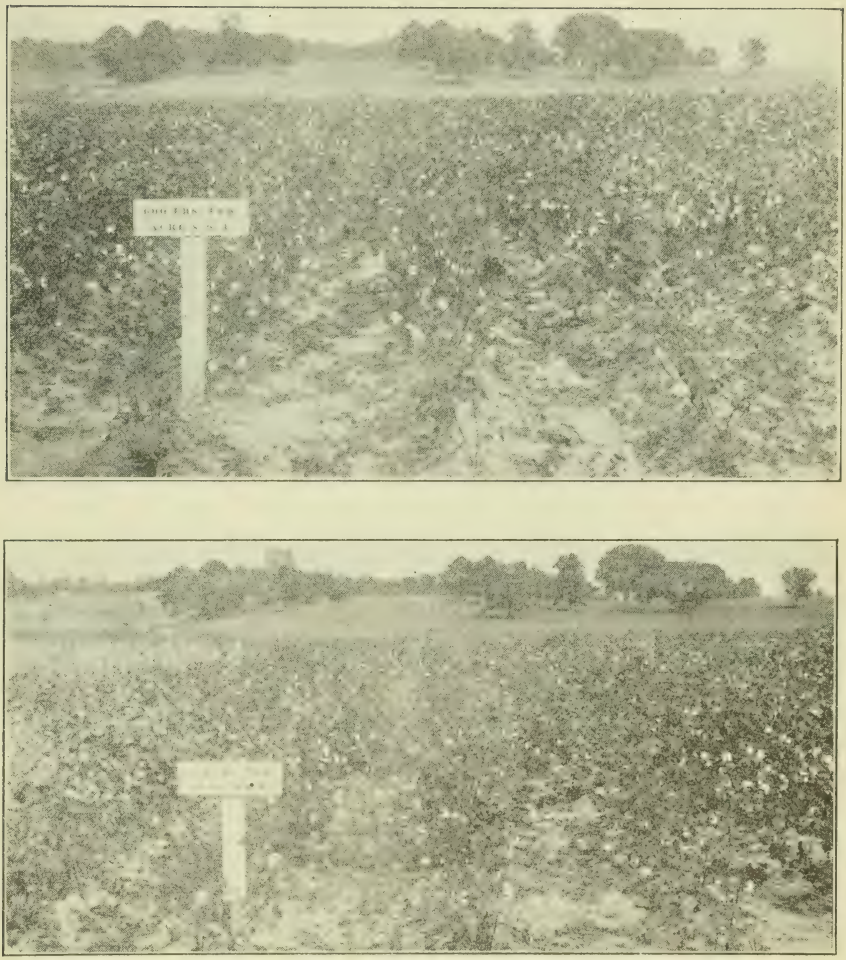


Fig. 6. Effect of fertilizer on cotton wilt control. Season 1927.

preventing defoliation from rust we also lessen the chances of the plant succumbing to wilt infection.

FERTILIZER EXPERIMENTS FOR COTTON WILT CONTROL AT THE SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION, POPLARVILLE. SEASON 1926 AND 1927.

During the season of 1926, some observations were made at the South Mississippi Branch Experiment Station at Poplarville on some cotton fertilizer plats which had been treated with varying amounts of phosphorus, nitrogen, and potash for five consecutive years. The plats in question were planted to Miss. Sta. Trice cotton. They were first observed about the middle of July and it was noticed at that time that there were marked differences in the amount of wilt in the different plats. A second visit was made to this Station on September 2 and the actual per cent of wilt determined in each plat by cutting the stalks of the plants for vascular discoloration. The arrangement of these plats, the results obtained, and the different treatments studied are presented in tables 3 and 4.

TABLE 3—ARRANGEMENT OF FERTILIZER PLATS ON COTTON WILT INVESTIGATIONS AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION. SEASON 1926

South

East	Plat 3 400 lbs. acid phosphate 150 lbs. ammonium sulphate 50 lbs. potassium sulphate	Plat 6 400 lbs. acid phosphate 150 lbs. ammonium sulphate 150 lbs. potassium sulphate	Plat 9 150 lbs. ammonium sulphate 100 lbs. potassium sulphate	Plat 12 400 lbs. acid phosphate 300 lbs. ammonium sulphate 250 lbs. potassium sulphate
	Plat 2 Check	Plat 5 Check	Plat 8 Check	Plat 11 Check
	Plat 1 400 lbs. acid phosphate 150 lbs. ammonium sulphate	Plat 4 400 lbs. acid phosphate 150 lbs. ammonium sulphate 100 lbs. potassium sulphate	Plat 7 200 lbs. acid phosphate 150 lbs. ammonium sulphate 200 lbs. potassium sulphate	Plat 10 400 lbs. acid phosphate 100 lbs. potassium sulphate

West

North

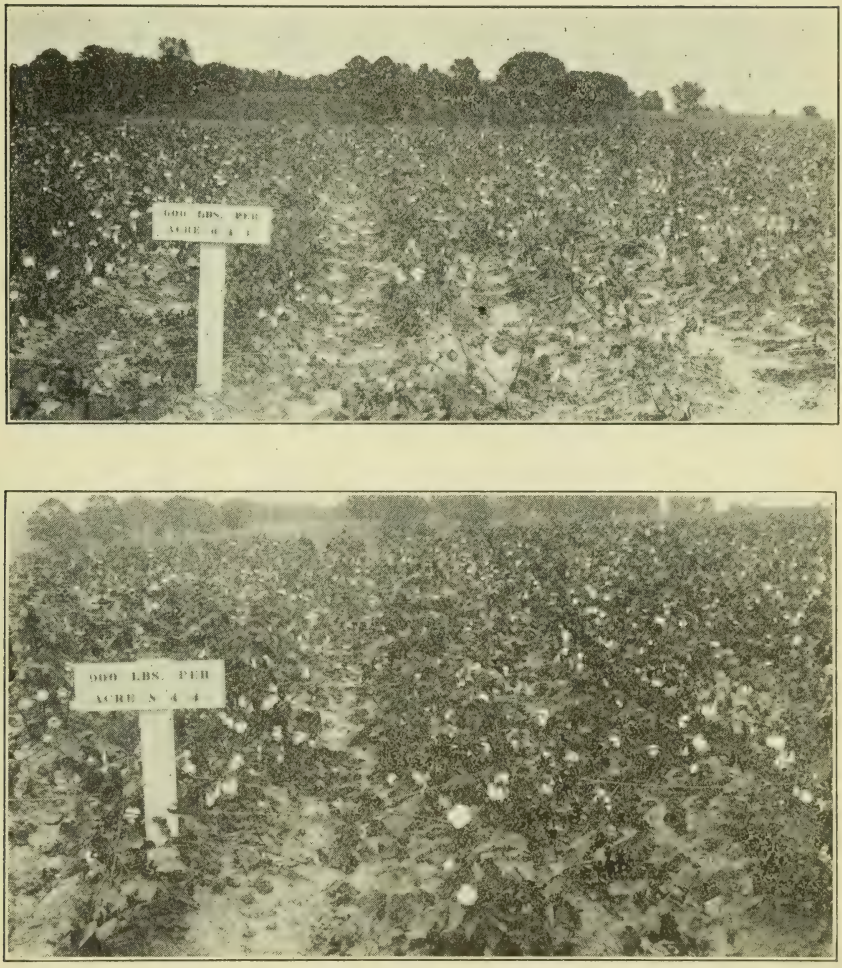


Fig. 7. Effect of fertilizer on cotton wilt control. Season 1927.

TABLE 4—PERCENTAGE OF COTTON WILT IN FERTILIZER TREATMENTS AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION. SEASON 1926*

Plat No.	Total plants	Wilted	Per cent wilted
1	493	226	45.84
2	622	138	22.19
3	691	102	14.76
4	773	8	1.04
5	810	18	2.22
6	762	7	.92
7	660	8	1.21
8	612	17	2.78
9	665	1	.15
10	613	0	0.0
11	512	1	.19
12	590	0	0.0

* Infection determined by cutting stems for vascular discoloration.

The data presented in table 4 appeared significant since Mr. E. B. Ferris*, Assistant Director in charge of the Station, had fertilized these plats in the same manner for a period of five consecutive years. It is noted that plat 1, which was fertilized with 400 pounds of acid phosphate and 150 pounds of ammonium sulphate, developed 45.84 per cent wilt whereas plat 3, which received the same amount of acid phosphate and nitrogen plus 50 pounds of potassium sulphate, developed 14.75 per cent wilt. A marked falling off in the amount of the disease is observed, too, in the plats which received larger amounts of the potassium sulphate. Because of the very favorable effects of potash treatment in seemingly reducing wilt infection in soil which was naturally infested with the cotton wilt fungus, it was deemed advisable to give this problem further study during the season of 1927. Accordingly, fifty-two 1/12 acre plats at the South Mississippi Branch Experiment Station were divided into four series, two of which were inoculated with the cotton wilt fungus, *Fusarium vasinfectum*. Virulent cultures of the fungus which had been grown on steamed rice for a definite interval were mixed with sand prior to planting, and later 7 pounds of this inoculum added to each row in the inoculated series. The re-

* The writer has had the hearty cooperation of Mr. E. B. Ferris during the progress of these eperiments at the South Mississippi Branch Experiment Station.

TABLE 5—EFFECT OF POTASH FERTILIZER ON COTTON WILT AT SOUTH MISSISSIPPI BRANCH EXPERIMENT STATION. SEASON 1927

Fertilizer formula	Source of potash	No. plats each series	Rate per Acre in lbs.	Pounds Seed Cotton				Per cent wilt in inoculated series
				Av. yield per Acre		Av. increase over check plats*		
				Uninoculated series	Inoculated series	Uninoculated series	Inoculated series	
No fertilizer	-----	2	---	140	367	-323	-271	24.3
8-6-0	Check	7**	600	493	640	---	--	23.6
8-6-8	KCl	4***	600	936	942	448	322	16.0
8-6-8	K_2SO_4	2	600	779	828	290	243	6.0
8-6-8	D. M. Salt	2	600	873	889	367	249	20.0
8-6-8	Kainit	2	600	906	966	424	340	5
8-6-4	KCl	3	600	915	972	437	339	5.4
8-6-10	KCl	2	600	876	900	403	256	7.7
8-6-12	KCl	2	600	783	864	288	258	16.3

* Check plats=8-6-0.
** Eight plats in uninoculated series.
*** Three plats in uninoculated series.

maining 26 plats were planted in the same way in two series but were not inoculated. Lone Star 65 cotton was used in these tests and the plantings made on April 11. The fertilizer treatments used were as follows: An 8-6-0 fertilizer was used as a check and placed over the above mentioned plats so as to occupy those which had been without potash at least since 1918. The other plats received fertilizer of the same composition of phosphorus and nitrogen, but in addition they had potash supplied from various sources, varying from 4 to 12 per cent. The sources used were kainit, double manure salt, sulphate, and muriate of potash. When the potash varied from an 8-6-8 formula the chloride was always used. Because of the necessity of allotting as check (8-6-0) plats which had not received any potassium since 1918, the replications in both the uninoculated and inoculated series were not the same in number but were interspersed between checks as uniformly as was possible.

These fertilizer treatments were observed on August 22 and some of them were photographed and are shown in figure 8. On October 21, after the cotton was harvested, the percentage of wilt infection was determined in each plat of the inoculated series by splitting the stalks for evidence of vascular discoloration. The yield per acre of seed cotton, the average increase obtained over the check plats in both the uninoculated and the inoculated series, and the per cent wilt are given in table 5. The per cent of wilt was determined only in the inoculated series although scattering infection developed in the plats which were not inoculated with the fungus.

In studying the results in table 5, it is noted that the check plats, 8-6-0 treatments (P-N-K), developed almost as much wilt as those which did not receive any fertilizer. The plats receiving potash from the sources indicated and varying in amounts from 4 to 12 per cent developed considerably less of the disease. On the other hand, the data show that increasing the potash to a maximum of 12 per cent in the form of KCl did not decrease wilt infection any more than those having formulas with lesser amounts of this salt. The yields, however, are noticeably increased whenever the potash salts were added, regardless of the source of this salt or the percentage which was used in the formulas. The 8-6-8 kainit and the 8-6-4 KCl are outstanding plats both as to minimum wilt infection and maximum yields. Moreover, these results indicate that areas on which these tests were conducted are highly responsive to applications of fertil-

Fig. 8. Effect of potash fertilizer on cotton wilt control. Season 1927.

izer containing potassium when used for cotton growing. Furthermore, such reactions as expressed in gain in yields would suggest that potash deficiencies undoubtedly exist in these soils and perhaps other similar soils in the coastal plain area of the State when used for cotton production. Again, as stated previously in this paper, it is essential that plant food deficiencies be corrected for the proper control of certain cotton diseases. Particularly is this true regarding potash for the control of rust. In overcoming rust development and subsequent defoliation of the plants, the writer is also strongly of the opinion that we increase their resistance to attacks by other diseases, especially wilt and Alternaria leaf-blight.

Therefore, in order to obtain maximum cotton production and adequate control of such diseases of the crop as rust, wilt, and leaf-blight, it would appear that many areas in the southern coastal plain section of the State, and doubtless elsewhere, should be liberally fertilized each season. Especially is this true of fields which are being cropped to cotton year after year. Where the above conditions exist, profitable returns should accrue from the use of fertilizers having 8-6-4 or 8-6-8 (P-N-K) formulas when applied at a rate varying from 600 to 800 pounds per acre.

RUST

A disease sometimes called "potash hunger", "black rust", or "yellow leaf-blight" is often seen on land of low fertility. Rust is common throughout the State and in the aggregate the losses are considerable. In 1924 and 1925 this trouble was especially prevalent in Mississippi; and while usually confined to the poorer soils, it was observed at this time in a destructive form in the buck-shot prairie, lime-land soil of Oktibbeha, Noxubee, Lowndes, Clay, and Monroe Counties. In many instances the cotton plants in fields were defoliated by the first week in August. The disease is very likely to appear on wet, poorly drained soils. Unfavorable weather conditions also favor the development of rust.

SYMPTOMS. Cotton fields affected by rust do not usually produce normal growth. The disease first becomes noticeable about the middle of August in this State, the leaves assuming a yellow mottled appearance between the veins. They later take on a reddish-brown color, curl up and drop off, leaving the stalk bare. Such plants do not set a top crop as a rule and, therefore, the yield is seriously reduced. The lint is often badly damaged being

much shorter and inferior in quality. Rust often develops in poorly drained fields or in irregular low spots and unless remedial measures are applied it may occur year after year in the same places (fig. 9).

CAUSE. Rust is due to unfavorable soil and weather conditions for the proper growth and development of the cotton plant. It is not due to any disease-producing organism or to injury by insects, although the leaves of plants affected by rust become weakened and later are usually attacked by various fungi

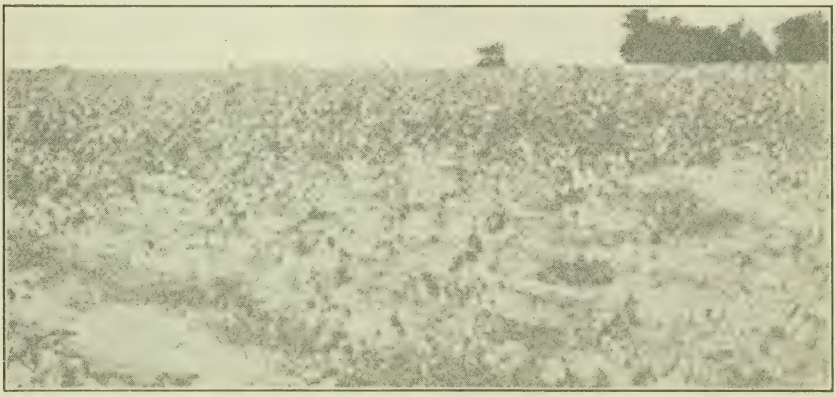


Fig. 9. A portion of a cotton field affected with rust. Note marked defoliation of plants.
(After W. W. Gilbert)

which ultimately destroy them. The most common causes for rust are lack of humus or vegetable matter in the soil, lack of potash, and lack of drainage. Serious outbreaks of rust usually occur in fields having the above deficiencies after prolonged periods of drouth have been broken by heavy rainfall.

CONTROL. Cotton fields which show general and severe rusting are usually in need of rotation with other crops in order to build up the humus supply which has been exhausted by continually cropping to cotton. The plowing under of green manure crops such as rye, cowpeas, velvet beans, or soybeans or the addition of a liberal application of barnyard manure will do much to improve soil conditions and to prevent rust. Kainit used at the rate of 200 pounds per acre or 100 pounds per acre of muriate of potash or other potash-containing fertilizers will help reduce rust damage. Some experiments were conducted for cotton rust control at the Central Experiment Station in 1925. Kainit was applied to 1/20 acre plats at the rate of 200

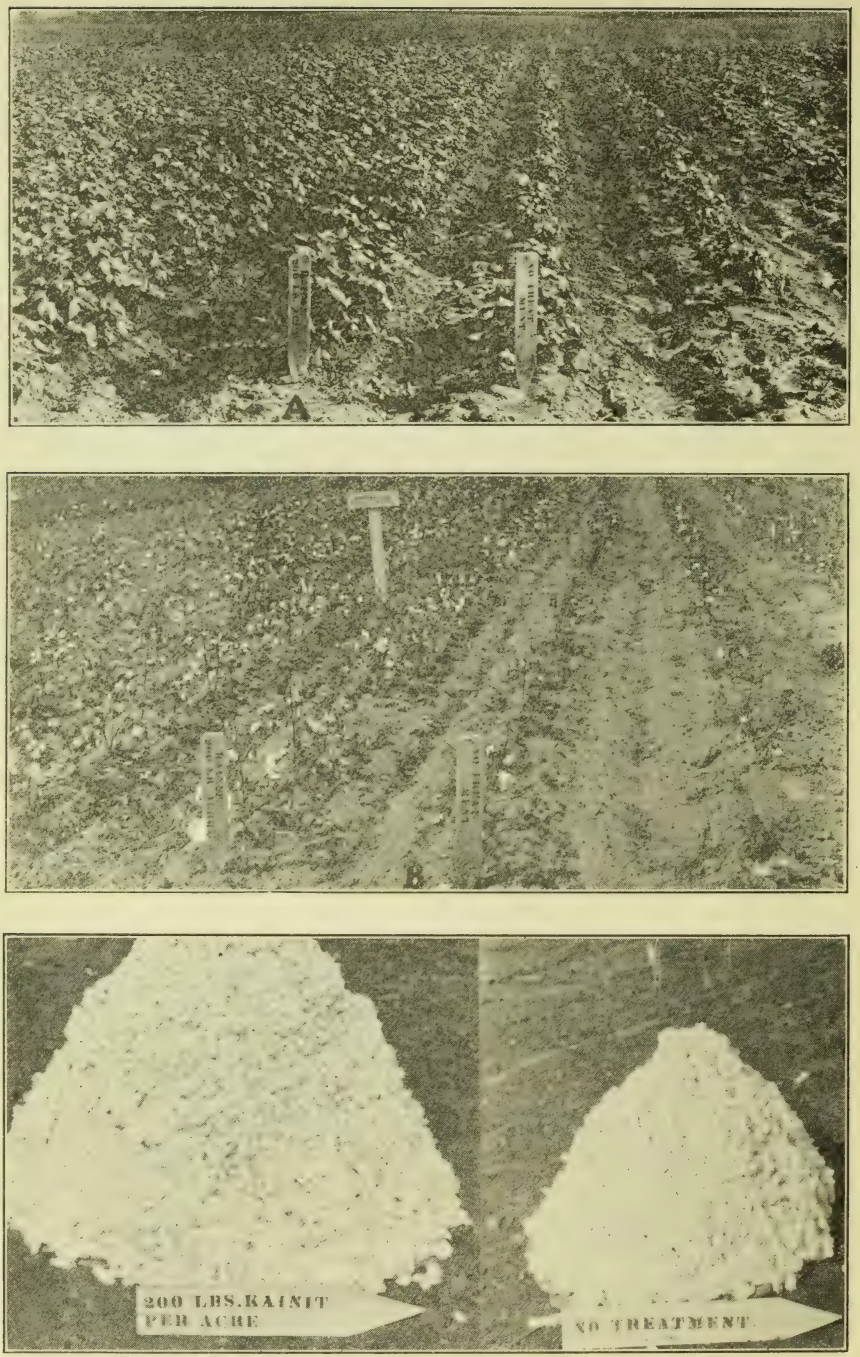


Fig. 10. Testing potash for cotton rust control at Mississippi Experiment Station. Season 1925. (A) Photographed in July. (B) Photographed in September. (C) Comparison of yields from above plats.

pounds per acre. These plats are illustrated in figure 10, and were photographed when the plants were showing defoliation by rust and also at maturity. The plats which received the kainit produced 500 pounds more seed cotton per acre and were not affected by the disease to any great extent.

ANTHRACNOSE

Anthracnose or pink boll-rot is one of the most widely known cotton diseases and may be, perhaps, even more widespread than wilt. It is common throughout Mississippi and is frequently troublesome and destructive in the Delta region or in any section of the State where cotton grows rank or where excessive moisture prevails at frequent intervals. On some farms, only a fractional per cent of the crop is lost from this disease while, on others, the loss is from 40 to 80 per cent. This disease is estimated to cause a loss of approximately 3 per cent in Mississippi.

SYMPTOMS. Anthracnose or pink boll-rot, although primarily a disease of the boll, may also injure the stem, leaves, bracts, and cotyledons. The disease may also frequently be observed on the young seedlings. When diseased seed is planted the fungus begins to grow as the seedling germinates and may be seen as a leaf-spot on the young plant. In some cases, the stems of the young plants may be attacked and the plants killed shortly after germination but this occurs usually only during moist seasons. On plants which are approaching maturity, the disease is frequently observed on the leaves and on the bracts at the base of

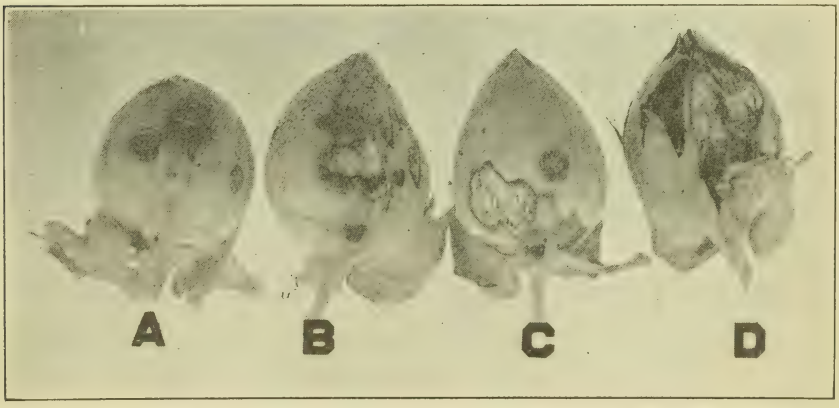


Fig. 11. Cotton anthracnose on bolls: (A) Early stage, small spot with water-soaked appearance and pinkish center; (B), (C), and (D) bolls showing advanced stages of anthracnose.

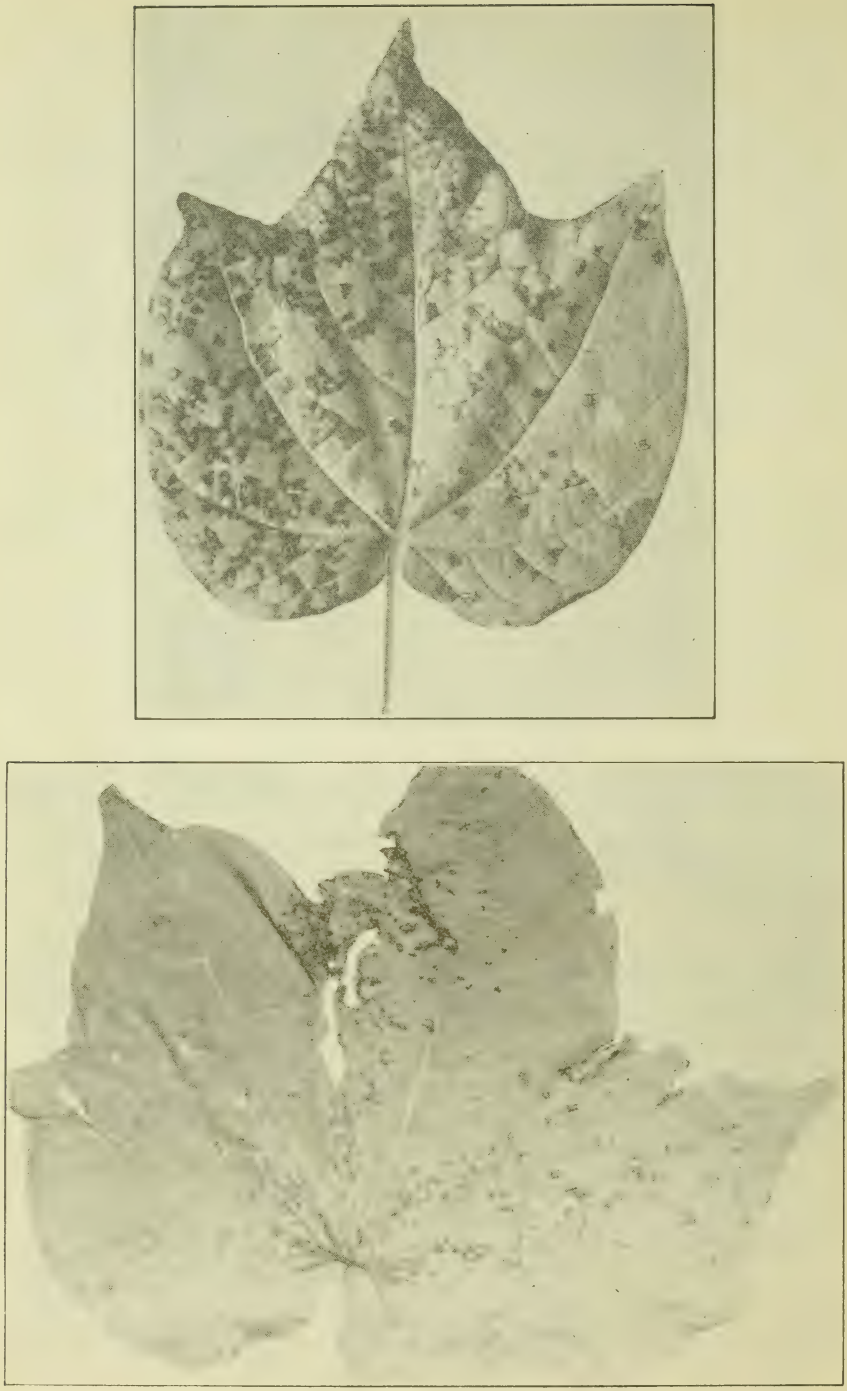


Fig. 12. Angular leaf-spot of cotton. Note angular, water-soaked, coalesced spots between the veins. (Photographed by J. M. Beal).

the bolls in the form of gray to brown, water-soaked spots. On the bolls, the disease first appears as small, round, water-soaked spots which later enlarge, become circular, reddish-brown at the margins, and sunken. Finally a large portion of the boll is involved and the spots develop characteristic pink centers (fig. 11). The pink centers of the spot are where the spores are borne. Climatic conditions are responsible for the abundance of the spores. If conditions have been favorable, large quantities of spores are produced and the pink color is very apparent; otherwise, they are scarce and the diseased areas have a grayish cast. The lint from such bolls is usually stained pink or in some cases may be entirely rotted and worthless.

CAUSE. Cotton anthracnose is caused by a fungus known as *Glomerella gossypii* (South) Edg., which may live over winter on diseased stalks in the field and infect the following crop, but is spread more commonly by infected seed. In diseased bolls many seed are killed by the anthracnose fungus. However, some may be attacked without being killed and may carry the fungus over in the seed coat until the following spring.

CONTROL. It has been found that losses from anthracnose can be greatly reduced by planting disease-free seed on clean land. Planting seed should, therefore, be obtained from fields which have a minimum of the disease and used on land that is rotated regularly. Rotation is most important not only for anthracnose control but for other diseases as well. The planting of two year old seed is also recommended for control of this disease since, in this climate, the fungus dies in the seed before the second year. Another method of controlling anthracnose is to plant varieties which are least affected by the disease. Half and Half, the majority of the Cook cottons, and Lone Star strains are rather susceptible to this disease and should be avoided in areas where the disease is usually serious. No varieties have been found to be immune but this is a problem which the writer and the Station Plant Breeder are investigating at the present time.

BACTERIAL BLIGHT (ANGULAR LEAF-SPOT)

The only bacterial disease of cotton which is, at present, of any significance is bacterial blight. The disease is also called bacterial boll-rot, angular leaf-spot, and black-arm, depending on the part of the plant attacked. It is only when the disease attacks the bolls, thereby producing boll-rot occasionally in de-

structive form, that it is considered of much economic importance. Bacterial blight undoubtedly occurs almost every season in varying amounts in almost every cotton field throughout the State.

SYMPTOMS. The most general and conspicuous evidence of the disease is on the under surface of the leaves where green-colored, water-soaked spots of varying sizes, usually from 1/8 to 1/4 inch in diameter, occur. Later, these spots penetrate to the upper side of the leaves forming elongated, irregular coalesced areas near the veins (fig. 12). Finally, they become dry, dark reddish-brown to black and have a rusty-red border. As the disease progresses, the spots increase in size and run together causing the leaf to turn yellow, curl up, and fall off. The first signs of this trouble on the boll are small, water-soaked, roundish spots which gradually enlarge, turn black, and then shrink as they are killed (fig. 13). Frequently, several locks

Fig. 13. Bacterial boll-rot. Note round, water-soaked spots on the bolls. (Photographed by H. H. Wedgworth).

or the entire boll may be so injured that they fail to open, or if they do open the lint is discolored and is of a low grade. Black-arm is the name commonly applied to the disease when it attacks the stems of cotton plants; so-called, because the outer bark of the branches is killed and then turns black. This phase of the disease is seldom encountered in Mississippi, and in fact, the "black-arm" phase is usually confined to Egyptian and Sea Island cottons, particularly susceptible varieties which are but rarely grown in this State.

CAUSE. Bacterial blight is caused by an organism known

as *Bacterium malvacearum* Smith, which enters the leaves, stems, and bolls through the breathing pores and kills the adjoining cells. Later it forms spots on the leaves, dead areas on the branches, and a decay of the bolls as previously indicated.

CONTROL. For several years, this disease has been observed to cause varying degrees of defoliation of cotton plants in this State and injuries to the bolls as described above. The extent of the damage caused by such infection is difficult to estimate. However, during periods of wet weather, it may cause rather severe defoliation of the plant, especially while they are young; but with the return of more favorable growing conditions, the plants put on new leaves, and the disease becomes decidedly less noticeable. Because of the probable small damage which this disease causes in Mississippi, no remedial measures have been worked out in this State for its control. However, the best known method of controlling it involves the use of disease-free seed combined with crop rotation. Since the disease may live over winter on the seed to a considerable extent, it is important that seed be saved from areas or fields which have a minimum of the disease. The treatment of the seed with sulphuric acid may be used to advantage to free them from disease germs, but seed treatment is not advised as a general farm practice.

SORE-SHIN (DAMPING-OFF)

Sore-shin or damping-off of cotton occurs quite widely throughout the State wherever cotton is grown. The disease is chiefly a disease of the small cotton seedlings, causing them to rot near the surface of the ground. It does not very often cause serious loss, although many young plants are killed during cold, wet, unfavorable springs.

SYMPTOMS. The young plants first show signs of weakness in the stem in the form of reddish-brown, sunken cankers near the surface of the ground (fig. 14). In severe cases, these encircle the stem or penetrate so deeply that the plants fall over and die. Frequently, on the return of warm favorable weather many plants, unless they are seriously injured so as to interfere with the normal functions, will recover and outgrow the injury.

CAUSE AND CONTROL. Sore-shin is caused by a fungus known as Rhizoctonia which seems to be present everywhere in the soil but which attacks the cotton plant only under conditions particularly favorable to the fungus and unfavorable to the plant.

No very satisfactory control methods are known. The best

Fig. 14. Sore-shin or damping-off of cotton (after F. D. Heald).

practice is to fertilize the plants liberally so as to give them a vigorous start and cultivate at frequent intervals in order to aid in drying out the soil near the plants as quickly as possible after wet periods.

MINOR COTTON DISEASES

ALTERNARIA LEAF-SPOT. Leaf-spot is caused by a fungus known as *Alternaria sp.* which produces an abundance of rusty-brown spots of irregular shape. Later as they enlarge they form concentric rings (fig. 15), and are usually quite prevalent in this State on the leaves about the middle of August. This leaf-spot appears in many cases to be associated with rust injury and in some instances has been observed to cause rather severe defoliation. No control measures are known and usually they are not necessary.

Fig. 15. Alternaria leaf-spot of cotton. (A) Early stage showing concentric rings in spots. (B) Later stage of infection.

DIPLODIA BOLL-ROT. This disease is common in Mississippi and undoubtedly causes appreciable damage during favorable years. The disease usually attacks the boll from the stem end and, according to Edgerton (3), it gains entrance into the tissues only through wounds such as weevil punctures, etc. After it has once gained entrance it very quickly destroys the whole boll. When the boll is entirely rotted, tiny blisters begin to appear on the surface, and from these black, sooty masses of spores are released and cover the whole surface of the boll. These may be scattered to other bolls which are punctured, or otherwise injured, and new infections result. The cause of the disease is a fungus, *Diplodia gossypina* Edg., which lives over in the field on diseased plants and which is also undoubtedly carried on seed. Rotation of crops and destruction of cotton stalks have been suggested as a means of control.

FUSARIUM BOLL-ROTS. Other common boll-rots of cotton frequently encountered in the State are those attributed to species of Fusarium fungi. One that is perhaps the more prevalent produces a brilliant pink rot of both the boll and the lint. The spores may also be seen as bright pink masses on the surface of the rotting bolls. This rot is not known, however, to attack uninjured bolls but those in all stages of maturity are quickly destroyed after the fungus once gains entrance.

Another boll-rot, apparently caused by a different species of this fungus, is one that commonly follows any injury or insect wound or lesions produced by angular leaf-spot. It causes a slow decay of the boll and lint, and the spores appear on the surface of the boll in irregular pale pink or nearly while patches. The lint is stained by the fungus, and later may be completely rotted. No remedial measures are known at present for these boll-rots other than such practices that will reduce injuries to the bolls by such agencies as angular leaf-spot, anthracnose, and insects.

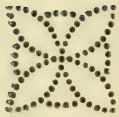
(3) Edgerton, C. W., The rots of the cotton boll. La. Agr. Exp. Sta., Bull. 137: 1-113, pls. 1-13. 1912.

BULLETIN No. 249 JANUARY, 1928

COTTON PRODUCTION

CENTRAL STATION

1927



MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

Recommendations

A cotton variety should be chosen after all conditions involved have been considered. Some of these conditions are marketing practices, type and attitude of labor, prevalence of cotton diseases, type and fertility of soil, and rate of fertilization.

As a rule, the cotton grower in the hill section can find a satisfactory variety among good Cleveland strains, D. & P. L. No. 4, Acala, Miller, and Lone Star, with possibly Delfos strains on fertile bottom soils.

The choice of a wilt resistant variety is restricted to Rhyne's Cook, Dixie Triumph, Miller, Lightning Express, and a few others more or less resistant.

Prepare a good seed bed and cultivate afterward to control weeds. Whatever is done, get the weeds. Allowing them to make seed is imposing a handicap on the following crop.

A fertilizer analyzing 8-6-4 or similar proportions is usually best, but conditions may require something different. Study conditions and fertilize properly. Plants will not grow without plant food from some source.

Plant enough good seed to secure a stand. Space plants two or three each foot to eighteen inches in rows three and one-half feet apart with a somewhat thicker spacing in three foot rows on thin soils. Secure a regular stand. Cotton is not produced on blank spaces.

COTTON PRODUCTION

By

J. F. O'KELLY and W. W. HULL

This publication reports recent variety experiments conducted at the Central Station and presents, in a brief manner, some of those practices which, if wisely followed, should make cotton production more profitable.

COTTON VARIETIES

Table 1 reports average results for certain varieties for five years. The period includes two wet seasons (1923 and 1926), two dry seasons (1924 and 1925), and a season (1927) nearly normal except for a late start. Only the most important data are given. It will be observed that the varieties are arranged in order of lint production and the rank in value is indicated.

TABLE 1.—FIVE YEAR AVERAGE, 1923-27, A. & M. COLLEGE

Variety	Per acre		Rank in value	Percentage	Length	Bolls per lb.
	Lb. Lint	Total value				
Cleveland 54	457.5	115.18	3	34.5	15-16	73
Cook	457.2	106.10	7	39.1	7-8	77
Half & Half	449.1	101.71	10	40.7	13-16	72
Piedmont Cleveland	447.4	111.99	4	33.9	7-8 f	73
Trice	430.9	116.72	2	31.4	1 1-16	84
Acala	419.9	106.15	6	35.8	1 f	69
Delfos 6102	409.3	117.14	1	31.9	1 1-8 f	83
Miller	405.6	109.62	5	33.7	1 1-16	60
Wan. Cleveland	393.1	97.05	11	36.9	7-8	74
Lone Star	390.2	104.37	8	33.7	1 1-16 f	65
Lightning Express	343.5	102.56	9	30.7	1 3-16	82

Table 2, presenting a four-year average, is given in order that those interested in D. & P. L. No. 4 can make comparisons.

While an attempt has been made, in these and other variety tables, to give available and important data, the reader will observe that other considerations must be made. The attitude of labor toward varieties difficult to pick is becoming an important factor in many sections, while in other sections where soils are fertile or fertilizers are used liberally, this feature receives little consideration. Marketing conditions vary. It is possible for practically all growers to market cotton on its merits as to grade and staple, but comparatively few do so. As a consequence, the values used in these tables will not apply in all cases. The presence of a disease like cotton wilt must also receive attention. Where wilt infection is light, it may be best to use a prolific, susceptible variety and fertilize liber-

ally. Where infection is moderately heavy, a resistant variety should be combined with proper fertilizer practices. In severe cases of wilt infection, it may be best to grow crops other than cotton.

TABLE 2.—FOUR YEAR AVERAGE, 1924-27

Variety	Per acre		Rank in value	Percentage	Length	Bolls per lb.
	Lb. Lint	Total value				
Cook	495.6	104.25	8	39.5	7-8	80
Cleveland 54	485.8	111.13	2	34.4	15-16	74
Half & Half	481.0	98.01	11	41.2	13-16f	73
Piedmont Cleveland	472.2	106.63	5	33.9	7-8 f	73
D. & P. L. No. 4	469.8	113.32	1	36.6	1 1-16	73
Acala	440.2	104.53	7	35.7	1 f	69
Wan. Cleveland	440.1	97.76	12	36.7	7-8	74
Trice	439.6	106.79	4	31.4	1 1-16	85
Miller	426.1	105.67	6	33.5	1 1-16	61
Delfos 6102	419.4	109.35	3	31.7	1 1-8 f	84
Lone Star	412.9	101.01	10	33.7	1 1-16	65
Lightning Express	363.5	101.51	9	30.6	1 3-16	82

When all of these cotton production and marketing factors have been considered, it appears best for growers in the hill section of Mississippi to use vigorous growing varieties having a staple of an inch to an inch and an eighth, with the possible exception of semi-dwarf to dwarf varieties on fertile bottom soils. As an average proposition, vigorous growing varieties like D. & P. L. No. 4, Acala, and Miller, will do well on bottom soils, but the

TABLE 3.—STANDARD VARIETIES, 1927

Variety	Lbs. lint per A.	Total value per A.	Rank in value	Lint data			Bolls per lb.
				Percentage	Length	Cents per lb.	
Cook 1010	671.3	147.44	18	39.38	7-8	19.25	73
Acala	674.1	161.63	6	34.23	1	20.71	62
Cleveland Piedmont	672.3	158.91	7	32.41	15-16	20.09	68
Cleveland 54	667.8	158.63	8	33.05	15-16f	20.31	69
D. & P. L. No. 8	667.1	158.42	9	35.89	1	20.71	70
D. & P. L. No. 4	646.0	157.44	12	34.12	1 f	21.09	69
Cleveland Wilson	639.9	151.09	15	32.56	15-16	20.09	69
Trice, Miss. Sta.	633.1	161.74	5	30.70	1 1-16	21.71	78
Half & Half, M.	625.5	133.87	23	39.06	13-16f	18.75	67
Cleveland, Wan.	624.2	141.64	21	35.40	7-8 f	19.59	68
Willis	622.1	147.98	17	31.50	15-16	20.09	61
Cleveland. No. 5	617.6	157.89	11	32.48	1 1-16f	22.03	63
D. & P. L. No. 6	605.8	171.79	1	32.40	1 3-16	24.81	79
Delfos 911	599.9	166.31	2	30.29	1 1-8 f	23.81	76
Delfos 6102	580.5	162.04	4	29.29	1 1-8 f	23.81	75
Miller	577.5	143.29	20	31.35	1 f	21.09	60
Lone Star 168	571.3	145.35	19	33.26	1 1-16f	22.03	60
Delfos 1341	549.9	150.64	16	32.17	1 1-8 f	23.81	80
Lightning Express	549.0	158.29	10	29.71	1 3-16	24.81	74
Lone Star 65	540.5	136.11	22	32.87	1 1-16	21.71	62
Delfos 910	517.1	154.01	13	29.96	1 3-16f	25.81	67
Deltatype No. 5	515.6	162.79	3	28.22	1 1-4	27.25	68
Delfos 1374	514.4	153.77	14	29.40	1 3-16f	25.81	62

yields are low when rainfall during the growing season is excessive. The yields are low in poor seasons and high when seasons are nearly ideal. The use of varieties having a staple shorter than fifteen-sixteenths inch can hardly be justified except where no attempt is made to sell on a basis of staple length.

Table 3 is a report of results obtained from a test comparing standard varieties, most of which are available in commercial quantity. The test was planted April 27 in six replications. The early part of the season was too wet and fruiting was delayed a week to ten days by the cotton flea hopper. The latter part of the season was normal to dry. Some poisoning for weevil control was done during the first half of August, but light showers removed the poison before it had done a great deal of good. Very few bolls were set after the middle of August.

TABLE 4.—STANDARD AND NEW VARIETIES, 1927.

Variety	Lbs. lint per A.	Total value per A.	Rank in value	Lint data			Bolls per lb.
				Percentage	Length	Cents per lb.	
D. & P. L. 4128-32	570.1	140.81	1	36.25	1 1-16	21.71	85
Miller 3297	534.1	134.48	2	32.89	1 1-16	21.71	59
Miller 3286	533.1	129.98	3	34.05	1 f	21.09	60
Cleveland 54	526.0	119.63	7	35.03	7-8 f	19.59	78
D. & P. L. 52-310	504.9	118.24	8	38.55	1	20.71	79
Miller	504.6	123.54	5	33.38	1 f	21.09	62
Stoneville No. 2	477.6	119.65	6	36.00	1 1-16f	22.03	83
Cleveland No. 5	446.7	112.93	9	34.33	1 1-16f	22.03	71
Lightning Express	437.3	124.24	4	32.07	1 3-16	24.81	86
Miller 3291	435.9	107.75	11	31.90	1 f	21.09	63
D. & P. L. 2842-34	414.0	110.82	10	36.48	1 1-8 f	23.81	78
Cleveland 884	412.3	105.00	13	33.10	1 1-16f	22.03	72
Half & Half, M.	405.8	84.40	23	41.30	13-16	18.38	74
Delfos 6102	387.3	106.69	12	31.27	1 1-8 f	23.81	89
Delfos No. 2	369.4	104.76	14	32.39	1 3-16	24.81	87
Lone Star 285	361.2	95.92	16	34.37	1 1-8	23.31	71
Delfos 324	356.4	101.89	15	31.02	1 3-16	24.81	88
Stoneville No. 1	355.2	89.28	19	35.38	1 1-16f	22.03	70
Lone Star 65	349.5	86.93	21	34.96	1 1-16	21.71	71
Half & Half, L.	347.6	71.54	24	43.58	13-16	18.38	76
Lone Star 281	345.7	92.64	17	32.76	1 1-8	23.31	71
Lone Star 284	340.0	84.59	22	34.90	1 1-16	21.71	71
Foster No. 3	328.9	91.96	18	35.04	1 3-16	24.81	84
Deltatype No. 5	281.7	87.73	20	30.38	1 1-4	27.25	80

Table 4 should be of interest to growers who are looking ahead in cotton production. A few varieties are included which are standard and available in commercial quantity. Most of the numbers are new strains from various sources and represent, to some extent, material which will be available to growers in two or three years.

The planting date, seasonal conditions, cultivation, and insect damage were about the same for this test as for the preceding one. The soil used, however, was drier in nature and although fertilization was liberal in both cases, the vigorous growing types of cotton had a distinct advantage. This emphasizes further the wisdom of using hardy types of cotton on high, dry soils.

During recent years, reports of damage by cotton wilt (Fusarium vasinfectum), often called cotton blight, have been more numerous than in preceding years. These reports indicate that this cotton disease either is on the increase or growers are studying cotton more closely than formerly. It is entirely possible that there is a combination of these two conditions. As a result, the wilt problem has become sufficiently acute in scattered localities to require special attention.

TABLE 5.—WILT VARIETY TEST, 1927

Variety	Lbs. lint per A.	Total value per A.	Rank in value	Lint data			Bolls per lb.
				Percentage	Length	Cents per lb.	
D. & P. L. 4128-32	500.8	124.56	1	34.95	1 1-16	21.71	77
D. & P. L. 52-310	463.0	108.87	4	37.75	1	20.71	73
D. & P. L. No. 8	435.7	103.82	7	38.30	1 f	21.09	70
Dixie Triumph	421.7	98.60	9	34.05	15-16	20.09	73
Lightning Express	416.8	118.93	2	31.35	1 3-16	24.81	82
Miller	406.1	102.59	8	32.35	1 1-16	21.71	58
Watson	405.7	109.09	3	32.20	1 1-8	23.31	81
Super Seven	397.0	108.14	5	33.15	1 1-8 f	23.81	88
Cleveland 54	394.5	92.25	11	34.10	15-16	20.09	70
D. & P. L. No. 6	384.1	107.95	6	34.05	1 3-16	24.81	85
D. & P. L. No. 4	374.8	92.62	10	36.15	1 1-16	21.71	72
Cook, Rhyne	366.2	81.85	14	35.40	7-8	19.25	67
Lone Star 168	338.1	85.66	13	33.95	1 1-16f	22.03	72
Delfos 6102	313.4	86.59	12	30.80	1 1-8 f	23.81	88
Delfos 245	284.1	78.19	15	31.40	1 1-8 f	23.81	91
D. & P. L. 2842-34	283.0	76.89	16	33.60	1 1-8 f	23.81	80
Trice, Miss. Sta.	247.5	62.95	18	31.35	1 1-16	21.71	91
Delfos 1341	233.0	63.84	17	32.15	1 1-8 f	23.81	97

For several years, tests have been made comparing varieties for wilt resistance. These tests have been placed on soil naturally infected with wilt and three times in five years, this soil has been artificially inoculated with wilt spores. The results for 1927 are given in Table 5.

The comparative rating of wilt resistant and wilt susceptible varieties varies immensely from year to year. When the fruiting season is dry and long, wilt seems to do most injury and wilt resistant varieties appear at their best. When the season is short and wet with considerable weevil damage, early prolific varieties, which are usually wilt susceptible, do comparatively well. A great deal of this variation is due to the fact that nearly all wilt resistant varieties are somewhat late and only moderately prolific. Lightning Express seems to be the most outstanding exception to this rule at this time.

If wilt infection is moderately severe, a resistant variety should be used. Short varieties which have considerable resistance are Dixie Triumph, Rhyne's Cook, and Cleveland 54. Medium length varieties are Miller, which has considerable resistance, and D. & P. L. No. 4, which is semi-resistant. Staple varieties are Lightning Express, Super Seven, and Watson. Where wilt infection is slight, it is often best to use a prolific variety, provided proper fertilization is practiced. In case of extreme wilt infection, it may not be economical to attempt cotton production.

Regardless of the variety being grown, it is necessary to fertilize proper-

ly. The correct use of fertilizer on wilt infected soil will be as certainly profitable as on any other. It has been observed that wilt infected soils are nearly always deficient in plant food and that wilt seldom causes serious damage until the original fertility of the soil has been largely exhausted. The liberal use of nitrogen and potash has been found highly effective in enabling the cotton plant to tolerate wilt and phosphate is certainly essential on nearly all hill soils. At present it seems best to use a mixture having an 8-6-4 analysis. This mixture has been found most profitable for much of the hill section of Mississippi, particularly the east central portion.

The judicious use of animal manure should do much toward decreasing wilt injury. Livestock farms which grow practically all feed consumed seldom have manure which can be spared for cotton production, but liberal applications of manure, where it is available, to wilt infected spots will be very profitable.

The use of inoculated legumes, where they are turned into the soil, will perform the same function as the manure. Some winter legumes most suitable are several kinds of vetch (except on strictly lime soils), the Austrian Winter Pea, and Burr Clover. Perhaps the best summer legume is the Otootan soybean, with Biloxi and Mammoth Yellow in second and third place. Where considerable areas are wilt infected, a two-year rotation could be established. Some winter legume could be grown each winter, followed by soybeans the first year and cotton the second year. This rotation would, on many farms, be a drastic departure from the usual practice, but, if the legumes were inoculated and only the seed removed, the farmer woud have a real soil building program that would produce results.

CULTURAL PRACTICES

Safe cotton farming demands a well prepared seed bed. This may be obtained in several ways. Where the land is covered with a heavy growth of stalks, bean vines, or grass, flat breaking may be done in winter and the beds made a few weeks before planting. If the plant residue is not too great, the land may be bedded in the winter and rebedded a few weeks before planting. Other level land can be treated in the same way in the winter in order to lighten the labor load in the spring, but land subject to erosion or carrying cover crops cannot well be plowed until spring. Whatever the method used, the seed bed should be prepared in a way that will pulverize the soil well and long enough before planting that rains will settle the soil and make it firm. A loose seed bed is a handicap from which the crop often does not recover.

Cotton should be planted as soon as the danger from frost injury is over and the soil is warm enough for the seed to germinate promptly. Planting can usually be begun about the middle of April in the vicinity of A. & M. College. Planting can, of course, be started earlier farther south and should be later farther north. Dark, lime soils are usually ready for planting earlier than sandy soils. Planting before danger of frost is over is justified only where the farmer is ready and has seed to plant over if necessary.

The quantity of seed which should be planted to the acre will vary with the size of seed, the germinating percentage, and the width of rows. If the seed are high in quality and small or delinted, a half bushel will often

give a good stand, particularly if a hill drop planter is used. On the other hand, if the seed are big and poor in quality, and the rows narrow, a minimum of two bushels should be used or none at all. The safe quantity lies between these extremes and can be readily determined by an observing farmer. Using too little seed can be justified only where one is increasing a new variety for future planting. When it is purely a question of cotton production, being stingy with seed is false economy.

When the young cotton plants have begun vigorous growth, they should be thinned to two or three plants a hoe width in rows three and one-half feet apart where the land is moderately fertile or better. On thinner hill soils, it will usually be best to leave three or four plants a hoe width in rows three feet apart. It is assumed that a hoe width will vary from one foot to eighteen or twenty inches, depending on the laborer, the frequency of young plants, and the quantity of grass to be removed. The stand should be regular. Too many missing hills can easily lower the yield more than too few plants to the hill.

Aside from thinning the young plants to the desired stand, all cultural operations, including hoeing and plowing, should be aimed principally at weed control. While cotton is injured less by deep cultivation than many crops similar to corn, there is no good reason for cultivating more deeply than is necessary for weed control. Cotton should receive, as nearly as the season will permit, a shallow cultivation as soon after each rain as possible and, in dry periods, as often as necessary to kill weeds which may have germinated since the previous cultivation. Although no weeds may be present just after a rain, it is necessary to prevent the formation of a hard crust in order that it will be possible to cultivate when weeds do appear.

Because of the immense expense involved in adequate weed control in areas badly infested with coco, some farmers have experimented with checked cotton. Although this results in a slight decrease in the yield, the cost is materially decreased. Less hoeing is required and the power machinery used is efficient and cheap. The success of this method seems to justify its continuation.

Checked cotton is usually planted in hills three or three and one-half feet each way with a two-row planter with checking attachment. Planting is usually done on a flat seed bed after which drain furrows are made between the rows and in the direction in which the planting was done. The seeds are somewhat scattered when dropped and a cross cultivation should be given before any hoeing is done. This will eliminate plants which are out of line and when the hoeing is done, only those plants will be left which are in the right place. This practice reduces the trouble in later cross cultivations.

If checked cotton and the use of power cultivation, with a resulting increase in the acres per man, are to be extended widely, the change should be made gradually. It is generally agreed that the south as a whole can already produce more cotton than it can harvest promptly. The mechanical cotton .picker will probably arrive in a few years, but it is not now available and cotton growers should not make changes which will prevent prompt and economical cotton harvesting.

FERTILIZING COTTON

Many fields in the hill section of Mississippi are too poor to produce cotton economically. On many other fields, which are still fairly productive, the yield could be increased enough by the judicious use of fertilizer to make it profitable. Farming in many sections is slowly changing from a mining basis to one of manufacturing. That is, the raw materials in the form of fertilizer, seed, etc., must be supplied before profitable crops can be produced.

Nearly all thin lands in Mississippi require a complete fertilizer. This is always the case where cotton rusts and is usually the case where 600 pounds or more is applied to an acre. Where cotton does not rust, and where only small applications are being made, potash can usually be omitted.

A COMPLETE fertilizer is one that contains phosphorus, nitrogen, and potash. For example, an 8-6-4 mixture would contain 8 per cent phosphorus, 6 per cent nitrogen, and 4 per cent potash. The phosphorus in mixed fertilizers is nearly always supplied by super phosphate (acid phosphate). The grade usually sold on the market is 16 per cent, but the use of more concentrated forms is increasing and should be encouraged. Nitrogen is supplied by such materials as nitrate of soda, nitrate of potash, ammonium sulphate, calcium nitrate, leunasalpeter, urea, calcium cyanamid, cottonseed meal, and several other carriers. Potash can be supplied through muriate of potash, sulphate of potash, kainit, trona potash (another muriate), nitrate of potash, and a few other materials.

Experimental work covering the last three years indicates that a mixture having an 8-6-4 ratio of phosphorus, nitrogen, and potash is most generally profitable in the hill section of the state. In the south part of the state, excellent results have been obtained from 8-8-4 and 8-4-4 mixtures, while in the north part of the state, an 8-4-4 mixture has been generally most profitable, particularly where efforts are made to improve the soil by the use of legumes. As a general rule, the more legumes (if inoculated) and animal manure used in the cropping system the less nitrogen will be needed in the commercial fertilizers applied.

Experiments indicate that a complete fertilizer of the correct analysis will be most profitable when used at the rate of 500 or 600 pounds to the acre. On very thin soils this rate may be increased and, in general, it may be stated that the thinner the soil the higher the rate of application should be.

In general, mixed fertilizers should be applied ten to twenty days before planting. That is, it is desirable to have the fertilizer in long enough before planting that a rain will have settled the seed bed. On light sandy soils, it may be best to hold back a portion of the nitrogen and apply it as a side dressing immediately after the first hoeing. On heavier soils, apply all of the mixture before planting except where very heavy applications are being made, in which case, it may be desirable to apply a portion of the nitrogen as a side dressing.

Farmers who plan to side dress cotton should expend every effort to do the work on time. At the time of the first hoeing the labor requirement for cultivation is often heaviest and the beneficial effects of side dressing are often lost by getting the material around the plants too late.

The stand will sometimes be injured when fertilizer and seed are placed in contact. This is particularly true where the fertilizer is applied just at planting time and several days of dry weather follow. Fertilizer, when applied before planting, should be placed one to three inches below the seed or a little to either side. If these precautions are properly observed, fertilizer, even in heavy applications, should not injure the stand.

Many farmers object to the use of factory mixed fertilizers, and others object seriously to home mixing. Both parties are partly wrong. State laws and the desire to remain in business compel manufacturers to put out dependable mixtures. Factory mixtures will, as a rule, cost more per ton than the same plant food in raw materials for home mixing, but they will increase the yield as well as the same analyses home mixed, and sometimes better. Mixed fertilizer of the proper analysis, from a reputable mixer, is always worth the price.

On the other hand, many farmers can home mix to advantage. When properly planned, the work can be done when fields are too wet for outside operations and by labor which is usually doing nothing at such times. It will require work and willingness on the part of labor, and it will require study and attention to details on the part of the land owner, but these things are very desirable under any conditions. Laborers and land owners who do not possess these requirements must sooner or later be eliminated from agriculture.

For those who want to home mix fertilizer, the tabulation which follows will serve as a guide when mixing 600 pounds.

TO OBTAIN IN THE MIXTURE		
8% phosphorus use	6% nitrogen use	4% potash use
300 lbs. 16% super phosphate (acid phosphate)	240 lb. nitrate of soda, or 180 lb. Am. sulphate, or 138 lb. Leunasalpeter	50 lb. muriate of potash, or 50 lb. sulphate of potash, or 42 lb. Trona potash

It will be observed that mixtures made from the above tabulation will not total 600 pounds, but they will contain as much plant food as 600 pounds of an 8-6-4 factory mixed fertilizer. If 8 per cent nitrogen is wanted, use one-third more of the nitrogen carrier, and if 4 per cent nitrogen is wanted, use one-third less of the nitrogen carrier. Likewise, 200 pounds kainit can be used instead of other potash carriers.

MAINTAINING VARIETAL PURITY

There is a tendency in cotton varieties to degenerate. This tendency is probably least in those varieties which most nearly approach pure lines as a result of continued selection, and is probably greatest in those varieties which have had very little care and are largely plant mixtures. It is recognized that gin mixing is probably the greatest factor in cotton deterioration, but the trouble here considered is apparent through increase in the number of off-type plants, decrease in lint percentage, irregularity of staple, increase in the proportion of fuzzless seed, etc. These defects seem to increase even when gin mixing is avoided.

The average farmer can best keep good seed by securing, each

year or two, a few bushels of pure seed from a reputable breeder. These can be planted in a field far enough from other cotton to prevent mixing. The cotton thus produced can be picked and stored and then ginned when the bulk of the general crop is out of the way. If the gin is thoroughly cleaned, the seed thus obtained will be excellent for general planting and the process can be repeated each year or two with satisfactory results and little expense.

Cotton growers who have the training, inclination, and time may desire to do their own selection work. For these, mass selection or field selection is probably best. More complicated methods should be attempted only in rare cases, and by those who have had special training.

The one doing mass selection should go over his field after some of the bolls have opened and tag plants which appear to meet his requirements. A definite type of plant should be kept in mind and selections should conform to this type as nearly as possible. As a rule, production should receive first consideration. All plants which do not appear to be productive can be ignored. When a productive plant has been found, it should be studied for earliness, disease resistance, staple length, boll size, lint percentage, and other characteristics which are a part of the ideal in mind. When a plant approaches the standard sufficiently close, it should be tagged. These tagged plants should be picked later and all ginned on a gin that has been thoroughly cleaned. The seed obtained in this way can be planted sufficiently far from the other cotton the following year to prevent mixing and the work of selection can be repeated while the remaining seed from the increase field can be usd for general planting. Results can be obtained in this way although less rapidly than by more intensive plant breeding methods.

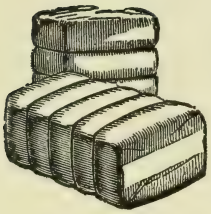
Cleaning gins when a change is made from one variety to another requires more work than ginners and growers usually appreciate. Dumping the seed roll is an essential part of the process, but requires only a very small part of the work involved. All conveyors in which seed cotton or seed can lodge must be examined. Cleaners, when used, will contain cotton which cannot be removed by simple turning. This work can be simplified by preparing two pieces of canvas as wide as the cleaner drum is long and long enough to wrap around the drum twice. These canvasses are padded with lint cotton, old sacks, or other material and then quilted together. When this contrivance is wound about the cleaner drum, the loose cotton can be rolled around to where it can be removed. The same process can be repeated on the feeder drum. A gin should not be called clean until seed cotton and seed can no longer be found in it.

Acala—L. E. Gleeck, Memphis, Tenn.
Cleveland, Piedmont—Piedmont Pedigreed Seed Farms, Commerce, Ga.
Cleveland, Wan.—Wannamaker Cleveland Seed Farms, St. Matthews, S. C.
Cleveland, Wilson—Lee Wilson Co., Wilson, Ark.
Cleveland, No. 5—Coker Pedigreed Seed Co., Hartsville, S. C.
Cleveland, 884—Coker Pedigreed Seed Co., Hartsville, S. C.
Cleveland, 54—Miss. Exp. Sta., A. & M. College, Miss.
Cook, Rhyne—Rhyne Bros., Benton, Ala.
Cook, 1010—D. N. Williamson Estate, Cedar Bluff, Ala.
D. & P. L. No. 4—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 6—Delta and Pine Land Co., Scott, Miss.
D. & P. L. No. 8—Delta and Pine Land Co., Scott, Miss.
D. & P. L. 52-310—Delta and Pine Land Co., Scott, Miss.
D. & P. L. 4123-32—Delta and Pine Land Co., Scott, Miss.
D. & P. L. 2842-34—Delta and Pine Land Co., Scott, Miss.
Delfos 2—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 245—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 324—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 6102—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Delfos 910—Delta Branch Sta., Stoneville, Miss.
Delfos 911—Delta Branch Sta., Stoneville, Miss.
Delfos 1374—Delta Branch Sta., Stoneville, Miss.
Delfos 1341—Delta Branch Sta., Stoneville, Miss.
Deltatype Webber—Coker Pedigreed Seed Co., Hartsville, S. C.
Dixie Triumph—L. O. Watson, Florence, S. C.
Express, Lightning—Coker Pedigreed Seed Co., Hartsville, S. C.
Foster No. 3—Coker Pedigreed Seed Co., Hartsville, S. C.
Half & Half, L.—M. B. Lee, Corinth, Mississippi.
Half and Half, M.—H. K. Mahon, Holly Springs, Miss.
Lone Star 65—Miss. Exp. Sta., A. & M. College, Miss.
Lone Star 168—Miss. Exp. Sta., A. & M. College, Miss.
Lone Star 281—Miss. Exp. Sta., A. & M. College, Miss.
Lone Star 284—Miss. Exp. Sta., A. & M. College, Miss.
Lone Star 285—Miss. Exp. Sta., A. & M. College, Miss.
Miller—Miss. Exp. Sta., A. & M. College, Miss.
Miller 3286—Miss. Exp. Sta., A. & M. College, Miss.
Miller 3291—Miss. Exp. Sta., A. & M. College, Miss.
Miller 3297—Miss. Exp. Sta., A. & M. College, Miss.
Stoneville No. 1—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Stoneville No. 2—Stoneville Pedigreed Seed Co., Stoneville, Miss.
Super Seven—Coker Pedigreed Seed Co., Hartsville, S. C.
Trice, Miss. Sta.—Miss. Exp. Sta., A. & M. College, Miss.
Watson—L. O. Watson, Florence, S. C.
Willis—Mrs. Stark Willis, Graysport, Miss.

BULLETIN 250 JANUARY, 1928

COTTON FERTILIZER EXPERIMENTS

By
C. B. ANDERS and W. W. HULL



MISSISSIPPI AGRICULTURAL EXPERIMENT STATION
A. & M. COLLEGE, MISSISSIPPI
J. R. RICKS, Director

RECOMMENDATIONS

For East Central Mississippi soils outside of the Prairie Belt: Use 600 to 900 pounds of an 8-6-4 fertilizer. This may be bought commercially or home-mixed as follows:

For 8% phosphoric acid: 300 pounds 16% superphosphate (acid phosphate).

For 6% nitrogen: 240 pounds nitrate of soda, or
180 pounds ammonium sulphate, or
240 pounds calcium nitrate, or
140 pounds leunasalpeter, or
80 pounds urea.

For 4% potash: 50 pounds muriate of potash, or
200 pounds kainit, or
50 pounds sulphate of potash.

For prairie soils: Use 600 pounds of an 8-8-0 mixture. If rust or leaf diesases are present, add 4% potash. This may be home-mixed by adding one-third more of the nitrogen carrier than is called for in a 6% mixture.

Legumes turned under offer a cheap source of nitrogen. Where this is done or where manure is used, reduce the amount of nitrogen in the fertilizer.

The opportunity for the greatest profit is lost by using small amounts.

Cotton is not produced on grass or blank spaces.

Advise with your county agent about your fertilizer practices.

FERTILIZERS*

Fertilizer investigations in 1927 were as a whole a continuation of experiments begun in previous years. This publication contains a report of the results of the following experiments with cotton: Analysis tests; amounts per acre; sources of nitrogen; sources of potash; and new materials. Reports of other phases of the fertilizer work will be published as sufficient data are accumulated to justify conclusions.

Methods of procedure in all these experiments were essentially the same as have been described in Bulletin 241. Summarized, they are as follows:

Land is selected for uniformity; each test is conducted on as many soil types as is practical; all treatments are repeated three or four times; plots are one-twentieth acre in size; border rows between each two plots are eliminated; the first and every fourth plot is a check plot used to measure the uniformity of the soil and as a basis for calculating the increase due to each treatment; all measurements, weights, applications, and harvesting are done by or under the personal supervision of a member of the Experiment Station staff.

FEEDING PLANTS.—The problem of fertilizers is one of feeding plants and the solution is found when we know: (1) What plant foods are needed in our soil; (2) What relative proportions of these foods should be used; (3) In what form these can be obtained most economically; (4) What amounts are most profitable; (5) How they should be applied; (6) What effect these fertilizers have on the future productivity of the soil.

In obtaining conclusive answers to these questions, one is led into very complex details involving chemical reaction, seasonal conditions, drainage, crop responses, diseases, the wide variation that exists in soils, and the economic value of the crop produced. The Experiment Station is investigating these as rapidly as the personnel and equipment will permit. Such recommendations as are made here are based on the experience gained from a large number of tests and represent the evidence as it is today.

PLANT FOODS.—Present information indicates that for Mississippi soils, phosphoric acid, nitrogen and potash are the only plant foods that when used return profitable yields. These three are usually the only plant foods carried in our fertilizing materials. The state law provides that the percentage of each of these contained in the material be printed on the bag. These percentages are stated in the order named above. An 8-6-4 fertilizer means one containing eight per cent phosphoric acid, six per cent nitrogen, and four per cent potash; that is, it contains eight pounds of phosphoric acid in one hundred pounds of the material, six of nitrogen, and four of potash. In the above fertilizer, we are interested only in the eighteen pounds of plant food contained. The other eighty-two of the one hundred pounds is composed of various materials which are usually worth-

*NOTE: J. F. O'Kelly and Roland Cowart have contributed material aid in conducting the experiments reported in this publication.

less as fertilizers. More or less of these materials are necessary as carriers of plant food, since they cannot be obtained in the pure state. One hundred pounds of an 8-6-4 fertilizer has the same value as two hundred pounds of a 4-3-2 fertilizer, or fifty pounds of a 16-12-8 fertilizer.

ANALYSIS.—This set of three figures stating the percentage of plant food is known as the anaylsis of the fertilizer. The Station has conducted eighty-four trials over a period of three years, covering many soil types to determine the correct analysis for cotton. All these tests have been conducted under practical farm conditions, the cooperating farmers following their own practices in preparation, cultivation, etc.

These tests are reported under three heads as follows:

(1) Choctaw County Tests; (2) All Hill and Flat Woods Tests; (3) Prairie Tests.

TABLE 1—ANALYSIS TESTS, CHOCTAW COUNTY.
Average 3 years—15 Trials

Pounds of material applied per acre			Analysis 600 lbs. of	Pounds of seed cotton per acre		Dollars per acre
Acid phos.	Nitrate of soda	Mur. of potash		Yield	Increase	Net Profit
			Varying Phosphoric Acid			
150	160	50	4-4-4	1092	685	35.87
225	160	50	6-4-4	1130	719	37.38
300	160	50	8-4-4	1094	652	32.52
			Varying Nitrogen			
300	160	50	8-4-4	1094	652	32.52
300	240	50	8-6-4	1352	938	48.31
300	320	50	8-8-4	1393	966	47.79
			Varying Potash			
300	160	0	8-4-0	1071	636	32.42
300	160	25	8-4-2	1121	676	34.10
300	160	50	8-4-4	1094	652	32.52
300	160	75	8-4-6	1091	661	32.71
300	160	100	8-4-8	1084	657	31.89

In the Choctaw County tests, Table 1, the soil used was of the sandy clay hill type, commonly found in the Short Leaf Pine area of Mississippi. These results indicate:

Where phosphoric acid was varied, that the amount of this food used should be as great or slightly greater than the amount of nitrogen.

Where nitrogen was varied, that a great increase in profits is possible by using a fertilizer high in nitrogen. Six or eight per cent should be used.

Where potash was varied, that 2 per cent to 4 per cent is sufficient.

Based on these results, the proper proportion of the three plant foods for these soils should be 8-6-4.

An average of sixty-eight trials in the Hill and Flat Woods soils of East Central Mississippi is given in Table 2. All these tests were grouped together because the results of the individual tests are very similar and lead to the same conclusions.

TABLE 2—ANALYSIS TESTS, HILLS AND FLAT WOODS
Average 3 years—68 trials

Pounds of material applied per acre			Analysis 600 lbs. of	Pounds of seed cotton per acre		Dollars per acre
Acid phos.	Nitrate of soda	Mur. of potash		Yield	Increase	Net Profit
			Varying Phosphoric Acid			
150	160	50	4-4-4	944	490	23.83
225	160	50	6-4-4	987	525	25.34
300	160	50	8-4-4	989	519	24.14
			Varying Nitrogen			
300	160	50	8-4-4	989	519	24.14
300	240	50	8-6-4	1108	640	29.50
300	320	50	8-8-4	1143	672	29.14
			Varying Potash			
300	160	0	8-4-0	898	428	19.33
300	160	25	8-4-2	965	498	23.18
300	160	50	8-4-4	989	519	24.14
300	160	75	8-4-6	1009	532	24.57
300	160	100	8-4-8	1028	542	24.52

A variation in phosphoric acid shows that the amount of this plant food should be only slightly greater than the amount of nitrogen.

A variation in the amount of nitrogen indicates a very high increase from the greater amounts.

A variation in potash indicates that around 4 per cent is most profitable. In some of the individual tests, no profit was obtained from the use of potash. In others, especially where rust and leaf diseases were present, amounts higher than 4 per cent were most profitable.

These results indicate a proportion of 8-6-4 as the most profitable on these soils.

TABLE 3—ANALYSIS TEST, PRAIRIE SOILS
Average 2 years—16 trials

Pounds of material applied per acre			Analysis 600 lbs. of	Pounds of seed cotton per acre		Dollars per acre
Acid phos.	Nitrate of soda	Mur. of potash		Yield	Increase	Net Profit
			Varying Phosphoric Acid			
150	160	50	4-4-4	1001	372	15.04
225	160	50	6-4-4	1018	383	15.02
300	160	50	8-4-4	998	329	11.49
			Varying Nitrogen			
300	160	50	8-4-4	998	329	11.49
300	240	50	8-6-4	1137	491	18.92
300	320	50	8-8-4	1247	592	22.82
			Varying Potash			
300	160	0	8-4-0	1003	346	13.82
300	160	25	8-4-2	1020	360	13.77
300	160	50	8-4-4	998	329	11.49
300	160	75	8-4-6	1002	321	10.22
300	160	100	8-4-8	1046	351	11.52

Tests for two years on soil commonly known as "Black Post Oak of the Prairie Belt" are reported in Table 3. The soil represented is typical of a large area of the cotton soils of this belt.

The variations in phosphoric acid indicate that a limited amount of this plant food can be profitably used on these soils. The amount should be equal or nearly equal to the amount of nitrogen used.

With an increase in nitrogen, profits were materially increased, the greatest profit being from eight per cent.

Potash variations on these soils indicate no increase in yield from its use and a consequent loss in profit. These tests were on soil free from rust. All soils where rust is present will respond profitably to the use of potash.

These tests indicate for these soils a fertilizer consisting of equal parts phosphoric acid and nitrogen, such as an 8-8-0, with 4 per cent potash added where rust or leaf diseases are present.

AMOUNTS PER ACRE.—To determine the most profitable amount of fertilizer to use, varying amounts were tried in each of the eighty-four analysis tests. Table 4 contains these results.

TABLE 4—AMOUNTS PER ACRE

Pounds of material applied per acre			Pounds per acre of 8-4-4	Pounds of seed cotton per acre		Dollars per acre
Acid phos.	Nitrate of soda	Mur. of potash		Yield	Increase	Net Profit
			Choctaw County			
300	160	50	600	1094	652	32.52
600	320	100	1200	1449	1051	49.95
900	480	150	1800	1686	1294	57.74
1200	640	200	2400	1765	1380	55.73
			All Hill and Flat Woods			
300	160	50	600	989	519	24.14
600	320	100	1200	1243	793	33.63
900	480	150	1800	1376	923	33.87
1200	640	200	2400	1428	982	29.71
			Prairie Soils			
300	160	50	600	998	329	11.49
600	320	100	1200	1251	610	19.89
900	480	150	1800	1421	760	20.61
1200	640	200	2400	1556	876	19.64

The indicated most profitable amount in each case is 1200 to 1800 pounds. An interesting fact is that 2400 pounds per acre was on an average more profitable than a 600-pound application. Twenty-four hundred pounds failed to produce a net profit in only a few instances.

These amounts tests were based on an 8-4-4 fertilizer. Results indicate that smaller amounts of an 8-6-4 would have given as good returns. The profit from 600 pounds of an 8-6-4 was very close to that from 1200 pounds of an 8-4-4. This further emphasizes the greater efficiency of an 8-6-4 fertilizer.

SOURCES OF PHOSPHORIC ACID.—No tests of sources of this plant food are reported here. It is considered advisable to obtain it from superphosphate (acid phosphate). This material is readily available and is usually the cheapest source of phosphoric acid. It usually contains 16 per cent phosphoric acid, but higher grades may often be obtained at a lower price per pound of phosphoric acid.

SOURCES OF NITROGEN.—Tests comparing six common carriers of nitrogen, conducted for three years are reported in Table 5.

TABLE 5—SOURCES OF NITROGEN

Treatment 600 Pounds 8-5-4	Average Increase Pounds of Seed Cotton per acre			
Source of Nitrogen	1925	1926	1927	Average
200 Nitrate of Soda	53	53	253	120
150 Ammon. sulphate	29	137	176	114
115 Leunasalpeter	137	20	207	121
200 Calcium nitrate	71	21	184	92
65 Urea	7	113	215	112
138 Cal. cyanamid	-100	92	133	42

These and other tests show a variation between seasons in the efficiency of these materials. On an average, all except calcium cyanamid have proven to be about equal in value when applied under cotton from seven to ten days before planting. These materials differ in the amount of nitrogen per 100 pounds, and thus should be bought and used on a basis of the amount of nitrogen contained.

It is advisable to use either of the first five materials mentioned in Table 5, or a combination of two or more. A selection should be made based on what material will supply the cheapest nitrogen.

SOURCES OF POTASH.—The results of two experiments conducted two years comparing potash carrying materials are given in Table 6.

TABLE 6—SOURCES OF POTASH

Treatment 600 pounds 8-6-4	Increase per acre Pounds seed cotton		
Source of potash	1926	1927	Average
Trona	225	375	300
Sulphate	243	462	303
Kainit	222	430	326
	2nd Test		
Muriate	393	639	516
Trona	351	457	404
Sulphate	430	551	490
Kainit	454	631	543

These tests were on soil where rust is present and which shows a high response to potash. The results indicate that the four materials tested are all highly efficient. Kainit leads in pounds of increase. It is advisable to use the form which will supply the cheapest potash.

METHODS OF APPLICATION.—A definite plan must be worked out in individual cases to fit soil and weather conditions, and adjusted to the available tools. A few points of consideration are:

High quantities of fertilizer in direct contact with seed will kill young plants. Do not place in a narrow band and then plant directly on this. See that fertilizer is well mixed in the bed.

Fertilizer should be applied 7 to 14 days before planting.

Side dressing should be made early, preferably immediately after chopping, that is, at "dirting." It is usually best to apply all fertilizer before planting to avoid the delay in side applications often experienced.

MISCELLANEOUS MATERIALS.—Various materials are on the market, carrying one or more plant foods. Tables 7 and 8 show a comparison of Ammophos, Nitropo, and Nitrophoska with a fertilizer of the same analysis mixed from super-phosphate, nitrate of soda, and muriate of potash.

EFFECT ON FUTURE PRODUCTIVITY.—This question has not been definitely answered and theories are advanced tending to credit or discredit certain materials. In practice, however, some benefit to immediately

TABLE 7—MISCELLANEOUS MATERIALS

Treatment 600 pounds 8-6-5	Increase pounds seed cotton per acre over 8-6-0 from acid phos. and nit. soda		
Materials	1926	1927	Average
Ammonium phosphate and Muriate of potash	403	424	413
Acid phosphate Nitrate of soda and Muriate of potash	393	639	506
Acid phosphate and Nitropo	413	566	489

TABLE 8—HIGH VS. LOW ANALYSIS MATERIALS

Treatment	1927 yield per acre
600 pounds 8-4-4 from Acid phosphate Nitrate of soda and Muriate of potash	1270
150 pounds 32-16-16 Nitrophoska	1187

succeeding crops may be expected. The unused nitrogen is often leached from the soil by drainage waters.

Such materials as ammonium sulphate tend to render soils permanently more acid. It is therefore not advisable to use this material in high quantities year after year on soils that are already acid in nature. This acid effect may be overcome by the application of limestone.

SUMMARY.—In a complete mixture, greatest net profits are obtained where the amount of nitrogen equals or very nearly equals the amount of phosphoric acid used.

Potash is needed where rust is present and on many other soils. Four per cent should be used on these soils and on all soils where it is not known that it is not necessary.

Potash did not return a profit on the Prairie soils tested.

Superphosphate (acid phosphate) is recommended as the source of phosphoric acid.

The readily soluble forms of nitrogen, such as nitrate of soda, ammonium sulphate, leunasalpeter, calcium nitrate, and urea are highly efficient and about equally effective as sources of nitrogen. Calcium cyanamid, as used in these tests, has not been satisfactory.

Kainit, muriate, sulphate and trona are all efficient potash carriers.

High quantities of fertilizer are profitable. There is more danger in using too little than in using too much fertilizer.

Ammophos 20-20 was not as efficient as a source of phosphoric acid and nitrogen as a mixture of superphosphate (acid phosphate) and nitrate of soda.

Nitropo was about as efficient as a source of nitrogen and potash as a mixture of nitrate of soda and muriate of potash.

In a one-season test, 150 pounds of nitrophoska (32-16-16) was about as efficient as 600 pounds of an 8-4-4 composed of superphosphate, nitrate of soda and muriate of potash.

List of Cooperating Farmers

Clyde Coleman, Weir, Mississippi.
J. B. Ray, Weir, Mississippi.
J. B. Hardee, Eupora, Mississippi.
C. F. Ferguson, Eupora, Mississippi.
W. C. Butler, Longview, Mississippi.
J. I. Cummins, Longview, Mississippi.
J. R. Ferguson, Longview, Mississippi.
W. D. Bell, Brooksville, Mississippi.
Bailey Hardy, Artesia, Mississippi.
W. H. Ottley, Steens, Mississippi.
Grafton Yeates, Starkville, Mississippi.